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CONTENTS.

	PAGE
Our Pupil Teachers' Course	515
The 1894 Scholarship Examination. By Dr. George Beach, M.A.	518
Teaching Notes on 'The Life and Duties of the Citizen'	524
The London School Board Scholarship Examinations	527
New Composition Stories.—Standard V. ...	531
New Reading Tests.—Standard III. ...	532
New Dictation Tests.—Standard IV. ...	533
Papers for Pupil Teachers. By John Adams, M.A., B.Sc., F.C.P., etc.	535
Exercises in French for Certificate Examination	537
Notes and Notions. By Richard Waddington	539
Teachers' Drawing Lessons.—Freehand.—Standard V. By E. Buffery Ridge ...	541
Honours Physiography Notes. By R. A. Gregory, F.R.A.S., and H. G. Wells, B.Sc. (Lond.), F.Z.S.	542
Our 1894 Certificate Class. By Dr. George Beach, M.A.	544
Our Publishers and their Representatives.—No. 1.—Messrs. Blackie & Son (London and Glasgow). With Portraits	555
Well-known Teachers at Work. XXVIII.—Mr. Ernest Gray. With Portrait ...	559
London Matriculation. By R. C. B. Kerin, B.A. (Lond.), and J. D. Lynam, M.A., F.C.P.	562
Notes on Physiology. By Walker Overend, M.B. (Oxon.), B.Sc. (Lond.)	566
Legal and Code Queries Column	569
Query Column...	570
Reviews	571

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Wisdom is humble that he knows no more.'—COWPER.

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OUR PUPIL TEACHERS' COURSE.

TEST EXAMINATION.

ENGLISH.

FIRST YEAR.—(BOYS AND GIRLS.)

(*Maximum Marks*, 120).

(*Answer Questions* 1 *and* 6, *and two other questions.*)

1. Analyse the appended passage, and parse the italicised words :—

'*Now* the deep stream of music *winds* along,
Deep, majestic, smooth, and *strong*,
Through verdant vales and *Ceres'* golden reign,
Headlong, impetuous, see *it pour*.' (40.)

2. Write down three methods, giving in each case three instances, of forming the feminine of nouns. (20.)

3. Employ the word *as* as different parts of speech. In each given sentence parse it. (20.)

4. (*a*) Form nouns from *write*, *float*, *duck*, *rough*, *list*, *eat*.
(*b*) Form adjectives from *brass*, *kind*, *love*, *beauty*, *hunger*, *sight*.
(*c*) Form verbs from *bold*, *cloth*, *pat*, *long*, *glass*, *start*. (20.)

5. Draw up a table of the personal pronouns. (20.)

6. Reproduce in your own words the story read by the examiner. (40.)

SECOND YEAR.

(*Answer Questions* 1 *and* 6, *and any two other questions.*)

1. Analyse the subjoined lines, and parse the words in italic :—

'*How* can man *die better than facing* fearful odds
For the ashes of his fathers, and the temples of *his* gods,
And for the tender mother *who* dandled him to rest,
And for the wife who *nurses* his baby *at* her breast?' (30.)

2. Paraphrase the above passage. (30.)

3. What are the three principal uses of the nominative case? (20.)

4. What is the difference between a preposition and a conjunction? Mention a few words, with illustrative sentences, which may be used as both parts of speech. (20.)

5. Select the prefixes and affixes, giving their meaning, from these words :—*unlikely*, *unlovable*, *underhanded*, *foolishness*, *gainsay*. (20.)

6. Write a short essay upon '*our food supply*.' (40.)

THIRD YEAR.

(*Answer Questions* 1 *and* 6, *and any two other questions.*)

1. Paraphrase the following extract :—

'*See* the wretch *that long has tossed* on the thorny bed of pain,
At length *repair his* vigour *lost*, and breathe and walk again.
The meanest floweret of the vale, the common sun, the air, and skies,
The simplest note *that swells* the *gale*, *to him* are opening *Paradise*.' (30.)

2. Analyse the foregoing stanzas, and parse the indicated words. (30.)

3. How may the predicate of a sentence be enlarged? (20.)

4. Give the derivation and meaning of the following words :—*impenetrable*, *permutation*, *inconsistent*, *presuppose*, *subterranean*, *subterfuge*. (20.)

5. What prepositions would you use after the words—*different*, *agreeable*, *opposite*, *coincident*, *worthy*, *inferior*. (20.)

6. Write a brief essay upon '*the responsibilities of Englishmen*.'

GEOGRAPHY.

FIRST YEAR.—(BOYS AND GIRLS.)

(*Maximum Marks*, 80.)

(*Answer three questions only, including Question* 5.)

1. What industries are carried on in the following river basins?—(*a*) Basin of Clyde, (*b*) Mersey, (*c*) Trent, (*d*) Yorkshire Ouse. Mention chief towns in each locality. (25.)

2. Mention only the chief cataracts and deltas. (20.)

3. Tell all you know of Balmoral, Berwick, Stornoway, Truro, Dunstable, St. Asaph, Tralee, Redditch, St. Ives, Devonport. (25.)

4. Where in the British Isles are the following industries carried on?—Woollen goods, lace, hardware, glass, chemicals, leather, silk, linen, railway plant. (25.)

5. Draw a map of Wales. (30.)

SECOND YEAR.

1. Name the chief ranges of mountains in Switzerland, with lakes and mountain peaks. (25.)

2. How is longitude calculated? How many miles equal 20° of longitude at the Equator? (20.)

3. In what British possessions are the grisly bear, kangaroo, opossum, crocodile, teak, diamonds, beaver, and sable found? (25.)

4. Where and what are Alsace-Lorraine, Lake Balaton, Plevna, Maladetta, Leyden, Cracow, Hammerfest, and Kiel? (25.)

5. Draw a map of Spain and Portugal, showing capes and bays, towns and rivers. (30.)

THIRD YEAR.

1. What are periodical, constant, and variable winds? Give examples. (20.)

2. Name the chief products of Turkey in Asia, Siberia, Natal, Sahara, Morocco. (25.)

3. Where and what are Irkutsk, Kalahari, Kilimanjaro, Dekkan, Goa, Lassa, Zambesi, Tchad? (25.)

4. What are the physical peculiarities of Africa? (25.)

5. Draw a map of Mediterranean Sea, showing islands and chief ports. (30.)

BRITISH MUSEUM

HISTORY.

First Year.—(Boys and Girls.)

(*Maximum Marks*, 80.)

(*Do not attempt more than three questions.*)

1. Give a brief account of the first Roman Campaign in Britain after Cæsar's death. (25.)

2. What measures were taken, and by whom, to prevent the incursions of the Picts and Scots? Give dates. (25.)

3. In a sketch map of Britain insert the kingdoms of the Heptarchy, with names of founders, and date of foundation. (30.)

4. What notable event happened in each of the following years:—61, 120, 411, 597, 787, 901, and 1002? (25.)

5. Explain the following terms:—Castra, Colonia, Fossa, Bretwalda, Danelagh, and Danegelt. (25.)

6. Write a short life of Dunstan. (25.)

Second Year.

1. State briefly what you know of the Battle of Senlac. (25.)

2. Why did Henry I. invade Normandy in 1106, and with what result? (25.)

3. Give a short account of the Conquest of Ireland. (25.)

4. Give date and clauses of the Provisions of Oxford. (25.)

5. Very briefly write what you know of the Lollards, Roger Mortimer, and Piers de Gaveston. (25.)

6. When did the Hundred Years' War commence? When did it cease? Give chief engagements with dates. (30.)

Third Year.

1. Two daring impostures took place in the reign of Henry VII., state briefly what you know of each. (25.)

2. What do you know of the Statute known as Poyning's Law? (25.)

3 Write a short account of the events which occurred between the death of Edward VI. and the accession of Mary. (25.)

4. What has rendered the following dates memorable:—1497, 1611, 1536, 1649, 1588, 1679? (25.)

5. What period in the time of the Tudors has been called the 'Age of Maritime Discovery'? What grounds are there for thus naming it, and what part did England take? (30.)

6. Very briefly say what you know of John Pym, Sir Francis Bacon, Robert Carr, and John Hampden. (25.)

NEEDLEWORK.

First Year.

(*Maximum Marks*, 60.)

(April Exam.)

Make a calico band, and upon it show a specimen of back-stitching, button-holing, and sew on a linen button. (60.)

(October Exam.)

Cut out the pattern of a child's first shirt, naming the material, quantity required, and its probable cost. Sew a linen button on calico, and make a button-hole. (60.)

Second Year.

(April Exam.)

Show on calico a specimen of seaming, back-stitching, button-holing, and sewing on tape. (60.)

(October Exam.)

With your nine inches of calico make up a small apron, showing hemming, tucking, gathering, and button-hole. (60.)

Third Year.

(April Exam.)

On flannel show two sides herring-boned, and two sides bound with flannel binding. (60.)

(October Exam.)

Cut out, and tack together, a paper pattern of a child's frock bodice, stating the age of the intended wearer, the material, and quantity required, and its probable cost. (60.)

TEACHING.

Second Year.—(Boys and Girls.)

(*Number of Marks*, 40.)

(*Answer two questions only.*)

1. Give a list of six '*varied occupations*,' and enumerate their educational value. (15.)

2. Write out a list of 20 sample questions in mental arithmetic, for Standard II., that would satisfy the requirements of H.M. inspector's instructions. (20.)

3. Show how you would teach '*local value*' of numbers to Standard I. (15.)

4. Explain the process of multiplying 4836 by 302. How could the class test their work? (20.)

Third Year.

1. What are the requirements in reading, writing, arithmetic, and geography for Standard V.? (15.)

2. Why should a school have several class-rooms? If you had only two class-rooms, for what subjects would you use them, and why? (20.)

3. Name some of the chief points that would influence in choosing the songs and recitations in a school. (15.)

4. Write notes of lessons on *one* of these subjects:—
   (*a*) The Rhine.
   (*b*) Evaporation.
   (*c*) Cocoa (*infants*). (20.)

EUCLID.

Second Year.—(Boys Only.)

(*Maximum Marks*, 50.)

(*Answer three questions only.*)

1. If there be equal angles, AOC and BOD, and AOB is a straight line, then also COD is a straight line. (14.)

2. From a point O in AB, any line, OD, is drawn. If angle AOD be bisected by OE, and angle BOD by OF, then FOE is a right angle. (18.)

3. If two triangles have two sides of the one equal to two sides of the other, each to each, but the base of the one greater than the base of the other, the included angle of the triangle with the greater base is greater than the included angle of the other. (14.)

4. The middle point of the hypotenuse of a right-angle triangle is equidistant from the three angular points. (18.)

Third Year.

1. At a given point in a given straight line to make a rectilineal angle equal to a given rectilineal angle. (14.)

2. Given the base and vertical angle of an isosceles triangle to construct it. (18.)

3. If the square on one side of a triangle be equal to sum of the squares on the other two sides, the triangle is right-angled. (14.)

4. To construct a square equal to the sum of three given squares. (18.)

ALGEBRA.

Third Year.—(Boys Only.)

(*Maximum Marks*, 50.)

(*Answer three questions only.*)

1. $12a^2 + mab - 12b^2$ is divisible by $4a - 3b$, leaving no remainder. Find the value of m. (18.)

2. Multiply $x^{2m} + x^m y^m + y^{2m}$ by $x^{2m} - y^{2m}$. (14.)

3. Simplify $\frac{x^2 - y^2}{x^3 - y^3} \times \frac{x^4 + x^2y^2 + y^4}{x^3 + y^3}$. (14.)

4. (*a*) Two men receive the same sum; but if one were to receive 15s. more, and the other 9s. less, the one would receive three times as much as the other. (8.)

(*b*) Two numbers differ by 2. If to their product 1 be added, the result is equal to the square of the intermediate number. Prove this. (8.)

MENSURATION.

THIRD YEAR.—(BOYS ONLY.)

(*Maximum Marks*, 20.)

(*Answer one question only.*)

1. The perimeter of a triangle is 120 feet, and the sides are proportional to 5, 9, 10. Find the area. (20.)

2. Find the area of a trapezoid, of which the parallel sides are 25 and 15 inches, and the perpendicular distance between them 1 foot. (20.)

ARITHMETIC.

(*Maximum Marks*, 100.)

(*Answer three questions only.*)

FIRST YEAR.—(BOYS.)

1. Reduce 12 acrs. 2 rds. 12 pls. to the fraction of 2 acrs., and multiply £37 10s. by the result. (30.)

2. A man paid away ·6 of his money, and afterwards ·75 of what was left. What decimal of the whole then remained? (30.)

3. Find the value of £·4375 + ·375 of a crown — ·8125 of a shilling, and reduce the result to decimal of 11s. 3d. (30.)

4. (*a*) If a vulgar fraction in its lowest terms can be represented by a terminating decimal, the factors of its denominator must be powers of 2 or 5. (*b*) Prove this, and apply the test to ascertain whether $\frac{3}{5}$, $\frac{91}{125}$, $\frac{21}{28}$, $\frac{77}{84}$, $\frac{72}{88}$, satisfy the conditions. (40.)

FIRST YEAR.—(GIRLS.)

1. If 14,400 lbs. of wool were bought at 5½d., and sold at 6¾d. a lb., what was the gain? (30.)

2. Make out the following bill:—126 yards @ 10½d. per yard; 39 loads @ 7s. 7d. per load; 59 yards @ 11s. 5d. per yard; 192 hours @ 7¾d. (30.)

3. (*a*) Find the greatest common measure of 17822 and 17803.

(*b*) *Prove* that it is the greatest common measure. (40.)

4. Find by Practice the weight of 478 articles @ at 3 tons 15 cwt. each. (30.)

SECOND YEAR.—(BOYS.)

1. Find the compound interest on £2,756 for 2 years at 4 per cent. per annum, correct to the nearest penny. (30.)

2. If 7 per cent. be lost by selling goods for £145 6s. 3d., how much per cent. would be gained by selling them for £168 15s. 0d.? (30.)

3. Find the cost of painting the four sides and the bottom of a tank 3½ yards long, 3½ feet wide, and 6 feet deep, at 4d. per square foot. (40.)

4. 9 fowls are worth 5 ducks, 7 ducks are worth 4 geese, 9 geese are worth 7 turkeys, and a turkey is worth 13s. 6d. How much is a fowl worth? (30.)

SECOND YEAR.—(GIRLS.)

1. As in First Year, Boys. (30.)

2. A party of men, women, and boys, 32 of each, earn £235 4s. Find what each man, woman, and boy earns, a man earning twice as much as a woman, and a woman twice as much as a boy. (30.)

3. A man spent $\frac{2}{3}$ of his money, and then found that $\frac{3}{5}$ of the remainder was 5s. What had he at first? (30.)

4. As in First Year, Boys. (40.)

THIRD YEAR.—(BOYS.)

1. (*a*) Explain the terms *brokerage, consols, dividend, premium.*

(*b*) If I sell out £3,000 3½ per cents. at 112, and re-invest in the 4½ per cents. at 119, how much do I gain in annual income? (30.)

2. In a certain examination every candidate was allowed to take either the Language Paper or the Science Paper, or both. 75·6 per cent. took the former, and 87·4 per cent. the latter. There were 1,700 candidates. How many took both papers? (40.)

3. A man mixes 36 gallons of whisky at 15s. per gallon with 36 gallons at 13s. 6d. per gallon, and adds 9 gallons of water. If he sells the mixture at the rate of 19s. per gallon, what per cent. did he gain on the outlay? (30.)

4. Find the present value of a bill for £2,287 10s. due 5 months hence, interest being at 4 per cent. (30.)

THIRD YEAR.—(GIRLS.)

1. (*a*) When is a fraction said to be in its lowest terms?

(*b*) Reduce to its lowest terms $\frac{8}{9}\frac{8}{8}\frac{1}{5}\frac{5}{0}$, and find the value of that fraction of £1 3s. 7¾d.

2. A property is divided among three persons in the ratio 17 : 23 : 27. The share of the second is £1,242 3s. 10d. By how much is the share of the third greater than that of the first?

3. If I pay £3·19375 for 3·0416 cwt. of sugar, how much is that a pound?

4. Explain how you would give a first lesson on Proportion to children.

(*For Answers to Mathematics, see end of Certificate Article.*)

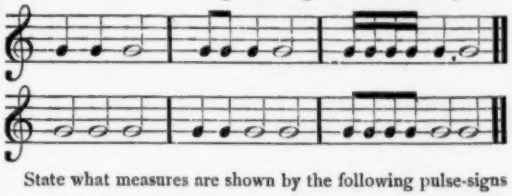
MUSIC.

FIRST YEAR.—(BOYS AND GIRLS.)

(*Maximum Marks*, 40.)

(*Answer two questions only.*)

1. Re-write the following, doubling the value of every note:—



OR

State what measures are shown by the following pulse-signs:—

(*a*) | : : | : : ‖

(*b*) | : | : | : | ‖ (20.)

2. Write below each of the following intervals its name:—

F : A : E
A F F OR

f¹ : l : m¹
l f f . (20.)

3. State the time signatures of the following bars:—

OR

What four contiguous notes of the scale are separated by the same steps as d, r, m, f? (20.)

SECOND YEAR.

1. Write major thirds above each of the following notes:—

A, B♭, E; OR

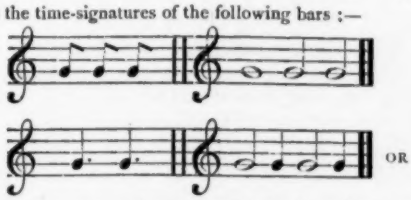
Which are the expectant notes of the scale? (20.)

2. State what major keys are shown by the following signatures:—
Three sharps, two flats, two sharps, four flats; OR

Re-arrange the following in order of pitch, placing the lowest first:—

t, d¹ m l, r¹ s, f l f, m¹
f, s, l, t, m f l d¹ r¹ m¹ (20.)

3. State the time-signatures of the following bars:—



OR

State what measures are shown by the following pulse-signs:—

(*a*) | : : | : : ‖

(*b*) | : | : ‖

(*c*) | : : | : : | : : ‖ (20.)

THIRD YEAR.

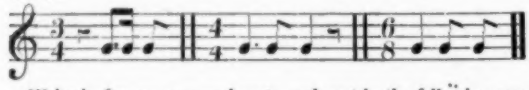
1. Write above (*a*) a perfect or major fifth, above (*b*) a minor sixth, above (*c*) a major third :—

(*a*) B♭ ; (*b*) C ; (*c*) B ; OR

Write a major third above each of the following notes :—

r ; f ; t (20.)

2. Complete each of the following bars by adding one note to the end :—



OR

Write in figures over each note and rest in the following passage its value in pulses, or fractions of a pulse :—

s .f : - .m	s. : t. l, t	d' : f., r
m :	d : —	(20)

3. State briefly the meanings of the following terms :—

(*a*) Pianissimo, (*b*) A tempo, (*c*) Largo, (*d*) Staccato. (20.)

THE 1894 SCHOLARSHIP EXAMINATION.

BY DR. GEORGE BEACH, M.A.,

Co-Author of 'A Manual of our Mother Tongue,' 'A Girls' Arithmetic.' Author of 'Elements of English,' 'Entertaining Readers,' 'Historical Readers,' etc.

I.—It should first be mentioned that the Education Department

(*a*) Does not *now* recognise as a qualified assistant in the interim between two consecutive Scholarship Examinations any ex-pupil teacher who has failed at the first examination, and is attempting the second.

(*b*) *Schedule V. Scholarship, footnote.*

A considerable amount of pressure has been brought to bear upon the Department in order to bring about the abrogation of this uneducational restriction respecting the date of the Science Certificates for which scholarship marks will count.

But 'my Lords' will not budge an inch further, and the obnoxious regulation will re-appear in the forthcoming code. In reply to our representations, 'my Lords' say that they have not inserted the note without mature deliberation and full consideration of its educational and other aspects, and cannot advise any alteration of it.

(*c*) Our readers should take care not to confuse the rules respecting Scholarship Drawing Subjects and those for the 'D' certificate. For instance, Perspective still is included in the former, although excluded from the latter, except in particular cases.

(*d*) We understand that more detailed information respecting Domestic Economy will be afforded in the new code than has been previously vouchsafed.

II.—A FEW QUESTIONS IN RELIGIOUS KNOWLEDGE.

1. What quotations from the Old Testament do we find in S. Matthew in relation to (*a*) the place of our Lord's birth ; (*b*) the slaughter of the Innocents ; (*c*) our Lord's sojourn in Egypt ?

State whence the quotations are derived.

2. We read that when Jesus healed the leper, He '*touched him.*' Explain *fully* the significance of this act, and give other instances in which our Lord disregarded the *letter* of the law.

3. (*a*) In what is it supposed that the sin against the Holy Ghost consists ?

(*b*) What inferences have been drawn from our Lord's teaching on this subject ?

4. Explain our Lord's actions and teachings in the matter and question of paying tribute (*a*) to the temple and (*b*) to Rome.

5. (*a*) Quote passages from this Gospel illustrating S. Peter's character and difficulties.

(*b*) Explain the replies drawn from our Lord by S. Peter's questionings.

6. i. Explain fully who were (*a*) the Pharisees, (*b*) Sadducees, (*c*) Scribes, and (*d*) Chief Priests.

ii. What controversies did our Lord have with the Pharisees and Sadducees at the close of His ministry ?

III.—ARITHMETICAL NOTES.

i. *Practice.*

(*a*) The main principles utilised in 'Practice' are two :—

(*a*) That of proportion as follows : '*As the part is to the whole, so is the cost of the part to the cost of the whole.*'

(*b*) That any fraction can be broken up into other fractions, whose sum shall equal the original fractions, and each of which shall be $\frac{1}{x}$, $\frac{1}{n}$, etc., of the original fraction.

Accordingly it is useful, as a preliminary exercise, to accustom the scholar to decompose any fraction into aliquot parts.

Thus $\frac{7}{12} = \frac{1}{2} + \frac{1}{12} = \frac{1}{2} + \frac{1}{6} \times \frac{1}{2}$.

It is simply a matter of convenience that we take $\frac{1}{12}$ as $\frac{1}{6}$ of $\frac{1}{2}$.

Practice would be of little value but for the fact that the relations between different denominations of a compound expression are generally expressed by factorisable numbers, such as 20, 12, 28, etc.

On the other hand, the method is of little use when such denominational numbers are prime, as in the case 7 days = 1 week.

If we have to find 6 days' expenditure at the rate of x£ per week, the method is cumbrous in the extreme.

Moreover, in many cases of Compound Practice, an absolutely accurate answer cannot be obtained without complex fractional operations among pence, etc.

(*b*) This and foregoing considerations show that *theoretically* Vulgar Fractions should be taught previously to Practice.

(*c*) Practice is generally taught on far too limited a scale, and in the commercial groove only.

There is actually no limit to the varieties of Practice sums, although they are generally confined to such examples as :—

1. *Find the cost of* 467 *articles* @ £3 7*s.* 6*d. each*, and
2. Find the cost of 4 tons 3 cwts. 2 qrs. at £7 3s. 6d. each.

No reasons exist why problems of the subjoined species should not be propounded :—

1. Find the weight of 467 articles @ 3 tons 7 cwts. 2 qrs. each.
2. Find the length of 467 articles @ 3 miles 7 furls. 2 pls. each.
3. Find the weight of 3 miles 7 furls. 2 pls. @ 3 tons 7 cwts. 2 qrs. per mile.
4. Find the length of 3 tons 7 cwts. 2 qrs. @ 3 miles 7 furls. 2 pls. per ton.

and so on, *ad infinitum.*

One peculiar kind should be noted :—

1. Find the intrinsic value of £40 13s. 6d. at 19s. 6d. per £.

Many problems in 'Bankruptcy' can be thus 'practically' dealt with :—

2. A merchant gives 1 ton 3 cwts. 2 qrs. gross weight for every ton net weight ; if the gross weight be 7 tons 3 cwts. 3 qrs., what is the net weight ?

(*d*) Many short cuts are traversable in Practice.

1. By introducing subtraction.
   The cost of 467 articles @ 17s. 6d. is best obtained by subtracting cost @ 2s. 6d. from cost at £1.
2. By combining denominations to form an aliquot part.
   Cost of 17 cwts. 2 qrs. = cost of (10 cwts. + 5 cwts. + 2½ cwts.).
3. By expressing a fraction of an article at once as the fraction of a £,
   203½ articles @ £4 6s. 0d. each, should have £203 6s. 8d. for top line.
4. By taking aliquot parts of a *multiple* of the unit.
   670 articles @ £7 7s. 7d. each, should be worked by 7s. = $\frac{1}{20}$ of £7, and 7d. = $\frac{1}{12}$ of 7s.

This principle is capable of multitudinous applications.

ii. (*a*) In *Proportion*, especially in statements evolved from discount problems, the 2nd and 3rd terms may often be with advantage interchanged ; *e.g.* :—

As £4 3s. 6d. : £5 :: £9 6s. 6d. : *x*.

(*b*) It is worth while seeing whether there be any kinship between the denominations of the different terms ; *e.g.* : 'If 5 tons 7 cwts. cost £37 9s., what will 4 tons 3 cwts. cost ?'

Here, call the 4 tons 3 cwts. £4 3s., and multiply by 7. Why ?

Try the following : 17 ft. 11 ins. cost £2 13s. 9d., what will 6 ft. cost ?

iii. *Fractions.*

(*a*) There are three methods of comparing Vulgar Fractions, so as to arrange them in order of value.

1. The ordinary one of reducing to a common denominator.

2. Reducing to a common *numerator*, *e.g.*,

Arrange in ascending order of value :

$$\frac{19}{32}, \frac{17}{31}, \frac{14}{25} = \frac{1}{1\frac{13}{19}}, \frac{1}{1\frac{14}{17}}, \frac{1}{1\frac{11}{14}}.$$

Now, by inspection, the *denominators* will be seen to be in the *descending* order $1\frac{14}{17}$, $1\frac{11}{14}$, $1\frac{13}{19}$, ∴ the fractions are in *ascending* order of $\frac{17}{31}$, $\frac{14}{25}$, $\frac{19}{32}$.

3. By separating common factors from denominators.

$$\frac{22}{91}, \frac{19}{78}, \frac{16}{65} = \frac{22}{7\times13}, \frac{19}{6\times13}, \frac{16}{5\times13}$$
$$= 3\tfrac{1}{7} \div 13,\ 3\tfrac{1}{6} \div 13,\ 3\tfrac{1}{5} \div 13.$$

∴ The fractions are already in ascending order of value.

(*b*) A mixed repeater can often be dealt with as follows :—

$$\cdot63\dot{6} = \cdot63\frac{2}{3} = \tfrac{189}{300}.$$
$$\cdot7814285\dot{7} = \cdot784 = \tfrac{98}{125}.$$

IV.—Latest Geographical Items.

(*a*) *Emigration in* 1893.

In 1893 the number of people who left the United Kingdom for places out of Europe was 307,750, as against 321,397 in 1892.

Of this total 209,117 were of British origin, as compared with 210,042 the previous year.

Of the 307,750, the English numbered 134,302, Scotch 22,660, Irish 52,155. In 1892 the numbers were 133,815, 23,325, 52,902 respectively.

The great decrease occurred under the head of 'foreigners,' of whom 94,904 emigrated in 1893, whilst in 1892 the number reached 107,351.

For the month of December there was a decrease of 3,000, over 2,000 of which were of British origin.

(*b*) *Population of India.*

The probable population of the globe was estimated in 1890 to be 1,467,600,000.

In India alone, directly or indirectly under our influence, there are 288,159,672, or one-fifth of the whole human race.

All Europe has only a population of about 400,000,000, and England, France, Germany, and Italy combined only contain about half as many as India.

British India supports 221,356,187, and the Native States 68,803,485.

In 10 years 28,000,000 have been added to the population.

(*c*) *The British Army.*

In addition to the Indian native army, we have about 220,000 *regulars* enrolled. This is an advance of 2,000 upon last year.

These are composed of 144,000 infantry, 37,000 artillery, 20,000 cavalry, 8,000 engineers, 5,000 colonial troops, 4,000 army service corps, 3,000 medical staff, etc.

The British Isles retain 107,000 troops—England 74,000, Ireland 28,000, Scotland 4,000. In India 77,000 are stationed, in Egypt 5,000, and in our scattered dependencies 31,000. Gibraltar and Malta have 8,000 each, and South Africa 4,500.

Nova Scotia (the only portion of the Dominion of Canada garrisoned by imperial troops) accommodates 1,400.

We have no cavalry anywhere except in the British Isles, India, Egypt, and Natal, and no horse artillery except at home and in India.

(*d*) *Great Storm of November 16th to 20th*, 1893.

This storm was the most violent of recent years, and, so far as anemometrical records were concerned, the wind attained a greater velocity than had previously been recorded in the British Islands. The velocity of the wind was 96 miles in the hour from 8.30 to 9.30 p.m. on November 16th in the Orkneys, where the hurricane burst with such suddenness that it was described as like the shot of a gun ; and the wind afterwards attained the very high rate of 90 miles and upwards in the hour for five consecutive hours. At Holyhead the storm was terrific ; the anemometer recorded a wind velocity of 89 miles in the hour, and it was 80 miles or above for 11 hours ; while the force of a whole gale, 65 miles an hour and upwards, was maintained for 31 hours, and for 4½ days the mean hourly velocity was 54 miles. Many of the gusts were at the rate of 115 miles an hour ; and at Fleetwood a squall occurred with the wind at the rate of 120 miles in the hour. The storm was felt over the entire area of the United Kingdom ; and the wreck returns showed that disasters occurred with almost equal frequency on all coasts. Four weeks after the storm the official records gave the total loss of life on our coasts at 335, while there were 140 vessels which had been abandoned, or had foundered, stranded, or met with other severe casualty, involving either loss of life or saving of life by some extraneous assistance. There were 600 lives saved on our coasts by the aid of the Lifeboat Institution and other means. The storm could be tracked from the neighbourhood of the Bahamas on November 7, across the Atlantic, and over the British Isles to Central Europe on November 20.

V.—Euclid Deductions.

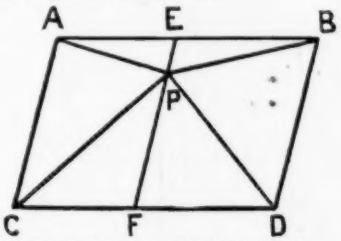
These are seldom (*a*) solved in an exhaustive manner, and are (*b*) generally dealt with isolatedly, instead of being mentally classed in proper order among the geometrical principles acquired, as tools to unpick more complex problems.

We will give an instance or two.

(*a*) *If any point be taken within a parallelogram and joined to the angular points, the sum of the two triangles whose bases are the opposite sides is equal to the sum of the triangles whose bases are the other pair of opposite sides.*

Here APB + CPD is to be proved = APC + BPD.

Draw EPF parallel to AC or BD.



Then APC is half AF, and BPD is half BF.

∴ APC + BPD is half ABCD, ∴ remainder APB + CPD is half ABCD.

∴ APB + CPD = APC + BPD.—Q.E.D.

At this stage the ordinary reader makes a full stop. He should, however, proceed and examine the following cases :—

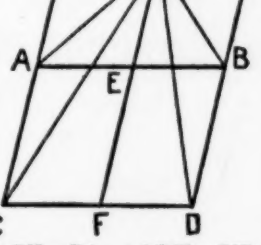
1. When P is at the intersection of the diagonals.
2. When P is in one diagonal.
3. When P is in a side.
4. When P is in two sides.

Even now much remains. The student should examine the result when P is *outside* the parallelogram. The following theorem will be discovered :—

If a point be taken outside the parallelogram, and joined to the angular points, the difference of the triangles whose bases are one pair of opposite sides is equal to the sum of the triangles whose bases are the other pair of opposite sides.

Here PCD − PAB is to be proved = APC + BPB.

Draw FEP parallel to AC or BD, and complete parallelogram DH.



Then DH − BH = DA ; ∴ ½(DH − BH) = ½DA.

But CPD = ½DH, and APB = ½BH.

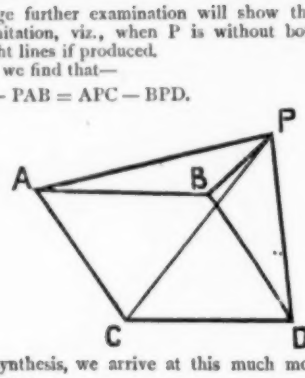
Also APC and DPB = ½FA and ½FB respectively ; that is, APC + DPB = ½AD.

∴ PCD − PAD = APC + BPD.—Q.E.D.

At this stage further examination will show that there is an important limitation, viz., when P is without both the pairs of parallel straight lines if produced.

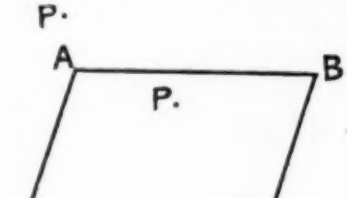
In this case we find that—

PCD — PAB = APC — BPD.



When, by synthesis, we arrive at this much more general and valuable theorem :—

If ABCD be a parallelogram, and any point P be taken and joined to A, B, C, D, then half the parallelogram ABCD is



equal to the sum or difference of PAC and PBD, according to whether P is within or without AC and BD, produced if necessary.

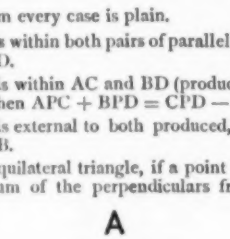
From this theorem every case is plain.

1. When P is within both pairs of parallel lines, APC + BPD = APB + CPD.

2. When P is within AC and BD (produced), but external to AB and CD, then APC + BPD = CPD — APB.

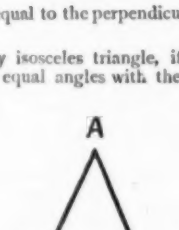
3. When P is external to both produced, then BPD — APC = CPD — APB.

(*b*) In any equilateral triangle, if a point be taken within the triangle, the sum of the perpendiculars from that point upon



the three sides is equal to the perpendicular from the apex upon the base.

Step i.—In any isosceles triangle, if lines be drawn from the base making equal angles with the sides, these lines are equal.



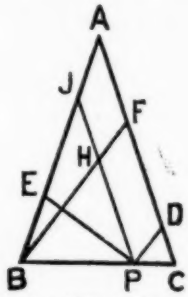
Proof.—Side BC, angles CDB, CBD, respectively = side BC, angles BEC, BCE.

∴ side DC = side BE.—Q. E. D.

Hence the perpendiculars from the angles of an equilateral triangle to the opposite sides are all equal.

Step ii.—In any isosceles triangle, if from a point in the base lines be drawn making equal angles with the opposite sides, their sum is constant.

Draw BF parallel to PD, and PHJ parallel to CA.



Proof.—Then by *Step i* BH = PE, and as FP is a parallelogram, FH = PD.

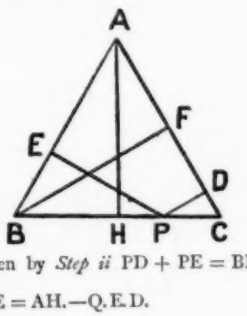
∴ EP + PD = BF.

Similarly from any other point P the lines PD + PE = BF.

∴ their sum is constant.—Q. E. D.

Step iii.—In an equilateral triangle ABC, any point P is taken in the base, and PD, PE, and AH are drawn perpendicular to AC, AB, and BC respectively, then PD + PE = AH.

Draw BF perpendicular to AC.

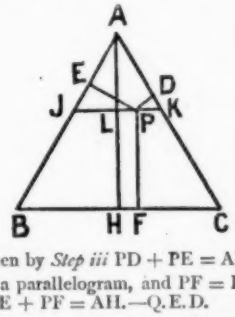


Proof.—Then by *Step ii* PD + PE = BF, but BF = AH *by Step i.*

∴ PD + PE = AH.—Q. E. D.

Step iv.—The original theorem (*b*).

Draw JPK parallel to BC.



Proof.—Then by *Step iii* PD + PE = AL.

Also LF is a parallelogram, and PF = HL.

∴ PD + PE + PF = AH.—Q. E. D.

(*c*) Theorem (*b*) can be proved much more expeditiously, but not nearly so profitably as regards deductional fruits, as follows :—

Refer to last figure.

Proof.— ABC = APB + BPC + APC,

but ABC = ½ rect AH. BC.

Also APB + BPC + APC = ½ rect PE. AB + ½ rect PF. BC + ½ rect PD. AC.

= ½ rect (PE + PF + PD)BC.

∴ ½ rect AH. BC = ...

∴ AH = PE + PF + PD.—Q. E. D.

VI.—We have made arrangements, merely to suit our own readers, and with no desire to interfere with existing agencies, for tuition based upon these articles, routines, and questions, by experienced teachers and graduates. Names of intending pupils should be sent to DR. G. BEACH, M.A., *Stanley Mount, Macclesfield.* The fees (*to be paid in advance*) are 1s. 6d. per week, or 5s. 6d. per month, or 15s. 9d. per quarter.

VII.—(*a*) *For Correspondence, see end of Certificate Article.*
(*b*) *See also Certificate Article for Science and Art Examinations.*

SELECTED GOVERNMENT QUESTIONS.

FIRST WEEK.

1. Write in Large-hand the word '*Ecclesiology.*'
Write in Small-hand—
'*Cowards die many times before their deaths.*
The valiant never taste of death but once.'

2. Analyse fully the following passage, and parse the italicised words :—

When Henry *the Eighth* attempted *to raise* a forced *loan* of unusual amount by proceedings of unusual vigour, the opposition *which* he encountered was *such as appalled even* his stubborn and imperial spirit.

3. Draw an outline map, with lines of latitude and longitude, showing the coast from the mouth of the S. Lawrence to the mouth of the Mississippi, the great lakes connected with the S. Lawrence, and the chief tributaries on the left bank of the Mississippi.

4. Name six famous mountains, one in each of the six famous divisions of the world, and describe the scene which would present itself to your eyes, had you an uninterrupted view from the summit of *one* of them.

5. Arrange in chronological order, and give the dates of ten battles fought on English soil, not mentioning more than one of those fought in the same quarrel.

6. Mention some of the particulars in which great progress (legislative or otherwise) has been made in the 55 years of her Majesty's reign.

7. Write full notes of a lesson on *one* of these subjects :—(*a*) Forest and forest trees, (*b*) prepositions and conjunctions, (*c*) (*for infants*) the primary colours.

8. What are the requirements of the Code in the Arithmetic of the Second and Third Standards? What sort of oral or unwritten exercises ought to be given in those classes?

9. Write a major third *above* each of the following notes :—B, D, E, B♭ ; OR

Describe the intervals formed by each of the following pairs of notes :—

se	f	se	f
m	l_1	r	s_1

10. What is the principal which will yield £14 2s. 6d. interest in 219 days at 4 per cent. Ans. £588 10s. 10d.

11. In what time will £385 4s. 2d. amount to £471 17s. 7½d. at 5 per cent. per annum simple interest? Ans. 4½ years.

12. (*Men only.*) Write out Euclid I., 38.
Write down the algebraical formulæ equivalent to the first seven propositions of Book II.
(*Women only.*) Describe the best method of establishing and conducting a school savings bank.

13. (*Men only.*) A goods train travels at the rate of eight miles an hour; at the end of 12 hours it meets a passenger train travelling in the opposite direction, which arrives at the original starting station 16 hours after the goods train left. At what rate is the passenger train travelling? Ans. 24 miles per hour.

(*Women only.*) Describe the duties of an under-nursemaid, and show in what way these duties differ from those of a maid-of-all-work.

14. (*Men only.*) A and B exchange purses. A has as many sovereigns as B has half-crowns, and as many sixpences as B has shillings. Find the ratio of the number of half-sovereigns to the number of sixpences, so that neither may lose by the exchange.
Ans. As 1 : 15.

(*Women only.*) Name the common vegetable poisons against which school children should especially be warned. What treatment have you been recommended to adopt in case of a child suffering accidentally from such poisons?

15. (*Men only.*) A triangular piece of ground, whose sides are 800, 500, and 500 yards respectively, is let for £30 per annum. Find the rent per acre. Ans. £1 4s. 2⅞d.

(*Women only.*) State (*a*) the amount of material required for a plain cotton frock with short sleeves for a child four years old, (*b*) the length of the body and skirt of the frock, (*c*) the size of the arm-hole, (*d*) the size round the arm, (*e*) the length of the waist-band.

16. Put into French :—
(*a*) The clock struck 12 (P.M.)
(*b*) He is five years old.
(*c*) What is the matter with you?
(*d*) He has come.
(*e*) He went to bed.
(*f*) I expect him.

17. Write down as many correlatives of *ne . . . as* you can, giving illustrative sentences.

SECOND WEEK.

1. Paraphrase the following passage, and parse the words in italics :—

'There is in souls a *sympathy* with sounds,
And as the mind is pitched the ear *is pleased*
With melting airs or *martial*, brisk or grave.
Some chord in unison with *what* we hear
Is touched within us, and the heart replies.
How soft the music of those village bells
Falling at intervals upon the ear
In cadence sweet! now *dying all away*,
Now pealing loud again and *louder* still,
Clear and sonorous *as* the gale comes on.
With easy force it opens all the cells
Where Memory slept.

2. Give three prefixes of Saxon and three of Latin origin, and three suffixes, by means of which nouns are derived from verbs, with two examples under each head.

3. Explain, as to the Upper Standards, why it is warmer in summer than in winter. Draw diagrams.

4. Describe a voyage from Southampton around Cape Horn to Lima, mentioning the most memorable places you would see.

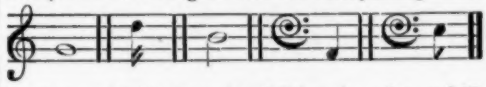
5. The Danish invasions of England may be divided into *three* periods, in each of which the invaders came with a different object. Name these, and give a few short details of each period.

6. Give a short account of any *five* of the following persons :—Thomas Cromwell, Marlborough, Hubert de Burgh, Bolingbroke, John Wilkes, Burke, Drake, Humphrey Duke of Gloucester, and Wilberforce.

7. If you were at liberty to choose between '*English*' and '*Geography*' as a class subject, which would you prefer, and why?

8. Which of the manual employments of an infant school is most helpful in the teaching of writing? Explain and illustrate your answer.

9. Write the pitch names and duration names of the following notes, and write the signs for rests of corresponding value :—



OR

Rewrite the following :—(*a*) Halving the value, and (*b*) doubling the value, of every note and rest—

s :s.f	m :-.f	r :	d : —

10. A person has equal sums invested in three undertakings which yield respectively 3 per cent., 4 per cent., and 5 per cent., and his total income is £240. What is his capital?
Ans. £2,000 in *each* undertaking.

11. Demonstrate that whenever four numbers are in proportion, the product of the first and fourth terms *must* be equal to the product of the second and third.

12. (*Men only.*) Write out Euclid II., 10.
Write down the algebraical formulæ corresponding to the last seven propositions of Book II.
(*Women only.*) In what different ways can potatoes be cooked? Describe the way which you regard as the most economical.

13. (*Men only.*) Find the square root of $x^4 + 9x^2 + 25 - 6x^3 + 10x^2 - 30x$. Ans. $x^2 - 3x + 5$.

(*Women only.*) State the cost and the method of making lemonade, barley-water, gruel, and arrowroot.

14. (*Men only.*) Two trains, A and B, are despatched from opposite termini of a railway at the same time, with speeds of 20

and 30 miles per hour respectively. A third train, C, is despatched after B, three hours later, with a speed of 40 miles an hour. What is the length of the railway if A pass C half-an-hour after passing B?

Ans. 450 miles.

(*Women only.*) What are the principal inexpensive disinfectants? How should they be used in times of sickness, in what quantities, and with what frequency?

15. (*Men only.*) Find the area of a rhombus whose side is 12 feet and one of whose angles is 120°. Ans. $72\sqrt{3}$ sq. ft.

(*Women only.*) What are the chief faults to be avoided in putting in a calico patch and a print patch?

16. For what incidents are Rephidim, Bethel, Dothan, and Gerar noted? Describe any one of them.

17. Write out an account of Our Lord's Temptation.

Third Week.

1. Write from Dictation :—

On the morning of the 31st May | 1533, | the families of the London citizens | *were stirring* early | in all houses. | From Temple Bar to the Tower, | the streets were fresh strewed | with gravel, | the footpaths were railed *off* | the whole distance, | and occupied on one side | by the guilds | *their* workmen | and apprentices, | on the other | by the city constable and officials | in their gaudy uniforms. | The principal streets | *had dressed* their fronts | in scarlet and crimson, | in tapestry and in cloth of gold. | The sheriffs were pacing up and *down* | on their great Flemish horses | *hung* with liveries, | and all the windows | were thronged with ladies *to see* the procession pass. | The abbots passed on, | *mitred*, | in their robes, | the barons followed in crimson velvet, | the bishops then, | the earls and *marquises*, | the *dresses* of each order | *increasing* in elaborate gorgeousness. |

2. Parse the words italicised of the above passages.

3. Give in such a way as to interest children a description of any *two* of these buildings :—Windsor Castle, The Kremlin, St. Peter's at Rome, The Tower of London, Cologne Cathedral, The Alhambra at Granada, The Fortress of Gibraltar.

4. Describe a voyage to Calcutta *viâ* the Suez Canal, and say what a traveller would see on his way.

5. Give a short sketch of the reign of Alfred, and show what special claims he had to the title of Great.

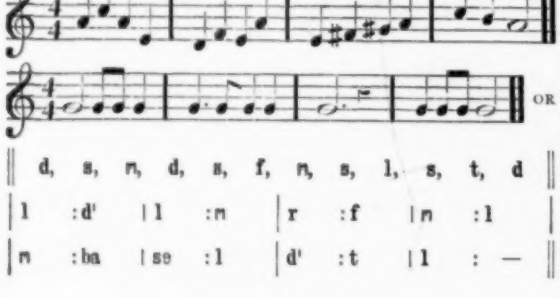
6. What English princes have taken part in Crusades? Give dates and a few brief details.

7. What subjects are best suited for '*Collective Teaching*'? In what subjects may it be injurious?

8. Take these lines, and show by what sort of questions and explanations you would try to make them intelligible and interesting to children :—

The western waves of ebbing day
Rolled o'er the glen their level way;
Each purple peak, each flinty spire
Was bathed in floods of living fire.
But not a sitting beam could glow
Within the dark ravine below;
Where twined the path in shadow hid
Round many a rocky pyramid,
Shooting abruptly from the dell
Its thunder-splintered pinnacle.—Scott.

9. Sing the following, having the key-note and chord previously given :—



10. Two pint measures are filled with milk and water; in one the ratio of milk to water is 6 to 1, in the other 7 : 1. If the contents of each be emptied into a quart measure, find the ratio of milk to water in it. Ans. As 97 : 15.

11. Explain why the words "borrowing" and "carrying" are often misused in teaching subtraction, and show, by the help of an illustration, what is the best way of making the meaning of that rule intelligible to young children.

12. (*Men only.*) Write out Euclid I., 41.
Write out and prove the converse of this proposition.

(*Women only.*) Mention some frequent symptoms of influenza, and describe the treatment suitable to that complaint.

13. (*Men only.*) The breadth of an oblong space is four yards less than its length. The area is 252 yards. Find the sides.

Ans. 18 yds. and 14 yds.

(*Women only.*) Name any inexpensive method of fumigating a sick room; and describe any simple way of ventilating the same.

14. (*Men only.*) One number is the square of another, and their sum equals six times the smaller of the two. Find the numbers.

Ans. 5 and 25.

(*Women only.*) What prudential measures may be adopted with children in cases of a severe cold, sore throat, eruptive illness, and chilblains?

15. (*Men only.*) The area of a rhombus is 990 sq. yds., and one of its diagonals is 55 yards long. Find the other diagonal.

Ans. 36 yards.

(*Women only.*) The principal stitches required for making articles of clothing are (1) hemming, (2) sewing, (3) felling, (4) running, (5) gathering, (6) whipping, (7) stitching, (8) back-stitching, and (9) herring-boning. Distinguish between these different stitches, and explain simply and clearly Nos. (3), (6), (8).

16. Give the personal pronoun of the first person in all its forms, and explain when they are used.

17. Write out the imperfect subjunctive of *avoir*, the present negative indicative of *parler*, also interrogatively the imperfect indicative of *être*.

Fourth Week.

1. Analyse the following lines, and parse the words in *italics* :—

The heights by great men *reached* and kept
Were not attained by sudden flight;
But they, *while* their companions slept,
Were toiling *upward* in the night.

2. Explain briefly the distinction between *shall* and *will*.
Comment on the following : '*I will be drowned, and nobody shall save me.*'

3. Explain as to a class of children the difference in time between London and Cairo *or* London and New York. Give reasons.

4. Show as fully as you can whence we obtain our supplies of wheat, silk, mahogany, wine, cheese, oranges, spice, maize, and dried fruit respectively.

5. Recount, in order of time, the principal quarrels between the Church and Crown before 1521, stating clearly but briefly the points in dispute in each case.

6. Give an account of the causes of any *two* of the following :—Pilgrimage of Grace, Jack Cade's rebellion, Risings in reign of Edward VI., and the Luddites.

7. Suppose you wished to explain to a higher class the difference between literal and figurative language, what illustrations would you give?

8. What are the advantages of teaching large-hand before small or running hand; and how far is it desirable to continue large-hand practice in the upper classes? Give a model copy in each hand.

9. Sing the following, having the key-note and chord previously given :—

SCHOLARSHIP OR FOURTH YEAR ROUTINE FOR APRIL, 1894.

DAYS	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
MONDAY	Brackets of Algebra (Theory and Practice) — Theoretical Needlework.	History from 1547 to 1572	'De Bello Gallico,' Chapters 31 to 33, *or* 'La Jeune Sibérienne,' pp. 46 to 53	Symbolical Expressions of Algebra — Ingredients of Food	Dates from 1461 to 1572	'De Bello Gallico,' Chapters 34 to 38 *or* 'La Jeune Sibérienne,' pp. 54 to 61	Fractional Simple Equations — Rules of Health	History from 1603 to 1637.	Latin *or* French Grammar	Algebraic Factors — Miscellaneous Geography	Dates from 1572 to 1660	'De Bello Gallico,' Chapters 39 to 41 *or* 'La Jeune Sibérienne,' pp. 62 to 68
TUESDAY	Euclid, Book I. — Diagram of Nightshirt	Political Geography of North America	Science *or* Drawing	First Seven Propositions of Euclid, Book II. — Flannel Sampler	General Geography of Europe	Science *or* Drawing	Definitions, Postulates, Axioms of Euclid, Book I. — Calico Sampler	Political Geography of New Zealand	Science *or* Drawing	First Sixteen Propositions of Euclid, Book I. — Diagram of Nightshirt	Political Geography of remainder of Polynesia	Averages and Percentages
WEDNESDAY	Drawing *or* Revision	Music. All the Minor Scales and Signatures, Common Musical Terms, *or* Chromatic Intervals Common Musical Terms	How to teach Geography	Compound Proportion	Paraphrasing and Repetition	Drawing *or* Science	Discount	Paraphrasing and Repetition	How to teach Mental Arithmetic	Theory of the Four Simple Rules	Parsing and Analysis	How to teach Composition
THURSDAY	Simple Equations — Savings and Investments	History from 1572 to 1603	Study English from 'Grammar'	Problems in Simple Equations — Preparation of Food	Saxon England after the Heptarchy	Parsing and Analysis	Algebraic H.C.F. and L.C.P. — Clothing and Washing	History from 1637 to 1660	Table of English Literature	Problems in Simple Equations — Miscellaneous Geography	England under the Normans	Science *or* Drawing
FRIDAY	Deductions upon Euclid, Book II. — Calico Sampler	Political Geography of South America	Theory of Practice and Proportion	Study any Notes on Euclid, Book I. — Diagram of Nightshirt	Map of Eastern States of America	Stocks	Euclid, Book II. — Flannel Sampler	Political Geography of Australia	Drawing *or* Science	Algebraic Formulæ of Euclid, Book II. — Any Needlework	Maps of Victoria and New South Wales	Drawing *or* Science
SATURDAY	Drawing *or* Revision	Science *or* Revision	Examination (Two Hours)	Drawing	Science	Examination (Two Hours)	Drawing	Science	Examination (Two Hours)	Drawing	Science	Examination (Two Hours)

| d	:d.d	:d	|	d	:-.d	:d	|
| d	: —	:-	|	d	:d.d	:d	||
| l	:se	| l	:d' |	t	:l	| se	:l |
| f	:m	| m	:ba |	se	:se	| l	: — ||

10. Reduce $\frac{3}{23}$ of $\frac{8}{9}$ of £81 13s. 4d. + $\frac{3}{41}$ of $\frac{82}{83}$ of 8s. 10½d.—$\frac{5}{7}$ of 9s. 11d. to the fraction of £6 10s. Ans. £4 17s. 6d.

11. Divide ·4214412 by ·002103 and 5·54 by 3.38. Give each answer in decimal form. Ans. 200·4 and 1·63.

12. (*Men only.*) Write out Euclid II., 11.

Draw a line PQ parallel to the base BC of a triangle. ABC, and terminated by the sides AB and AC such that PQ is equal to the sum of BP and CQ.

(*Women only.*) Define "Immediate Annuities" and "Deferred Annuities," and state, as nearly as you can, the value of an immediate annuity which a woman, fifty years of age, can purchase for £100.

13. (*Men only.*) $\sqrt{\frac{a+x}{a-x}} + \sqrt{\frac{a-x}{a+x}} = \sqrt{5}$

Ans. $\pm a\sqrt{\frac{1}{2}}$

(*Women only.*) Name six inexpensive and yet nutritious dinners for children attending our elementary schools. State the cost of the same, and the amount of materials required in the preparation of each.

14. (*Men only.*) If A gives B ten shillings, B will have three times as much money as A. If B gives A ten shillings, A will have twice as much money as B. What has each?

Ans. 22s. and 26s.

(*Women only.*) What course should be pursued to restore animation which has been suspended by drowning, and for what length of time should it be continued?

15. (*Men only.*) The arc of a sector of a circle is 42 yards, and the radius of the circle is also 42 yards. Find the area of the sector.

Ans. 882 sq. yds.

(*Women only.*) State the amount of material required, and the kind of material best suited, for making a shirt for a boy of 12, and give accurate measurements of its different parts.

16. What do you mean by a Sacrament? Prove from Scripture that Christ ordained the Sacraments, and for certain purposes.

17. Write out the Magnificat. Into what four divisions does it naturally fall?

TEACHING NOTES ON 'THE LIFE AND DUTIES OF THE CITIZEN.'

By the authors of 'Hughes's Constitutional Reader: a Series of Lessons on the Life and Duties of the Citizen.' (Published by Joseph Hughes & Co., Froebel House, St. Andrew's Hill, Doctors' Commons, E.C.)

II. THE EMPIRE.

LESSON XVI.—Great Britain and Greater Britain.

I. Explanation of Terms.

Great Britain includes England, Scotland, Wales, and all small adjacent islands. The **United Kingdom** includes Great Britain and Ireland.

The **British Empire** or **'Greater Britain'** includes the United Kingdom and all the British foreign possessions in the world.

II. Centre.

London is the centre of government, not only for the United Kingdom, but also for the whole of the British Empire.

[Illustrate by the city of London and 'Greater London,' which latter includes the whole metropolitan area. Endeavour to give some idea of London's size, population, and importance, by mentioning the fact that its population is greater than the aggregate populations of Paris, Berlin, St. Petersburg, and Vienna.]

III. Extent.

The extent of the British Empire is so great as to cover ¼ of the land area of the earth, and to include ⅕ of the earth's population. By turning the globe on its axis, we see that there never is a time during the 24 hours when the sun is not shining on some part of 'Greater Britain.'

[Refer to tabulated forms in Geography books which give names, areas, and populations of each part of the British Empire. Also use a map of the world on which all British possessions are marked.]

IV. Government.

Outlying parts of Greater Britain are called by different class names. Their names depend upon their relations with the mother country (England). These class names are—

(1) **Colonies** or lands mainly peopled by settlers from the British Isles, including—

(*a*) **Self-governing Colonies,** *e.g.*, New Zealand and Australia.

(*b*) **Crown Colonies,** *e.g.*, Hong Kong and Trinidad.

(2) **Dependencies,** in which the inhabitants are mainly natives dependent on British Rule, *e.g.*, India, Malta, and Gibraltar.

(3) **Protectorates** established over small states which Great Britain does not govern, but which she protects, *e.g.*, Bechuanaland.

All our foreign possessions, except India, are governed from the Colonial Office in London, and their government is superintended by the Secretary of State for the Colonies.

V. Peoples.

Peoples of almost all nations are included amongst British subjects in various parts of the world. They may be classified thus—

(1) **Native Races** in our possessions in the different continents.

(2) **Europeans** who have emigrated, or are descendants of emigrants.

(3) **'Our Brethren across the sea,'** who have emigrated to our colonies, or are descendants of English-speaking emigrants.

Our desire is to establish and encourage a bond of union amongst all these peoples. [Imperial coinage, Imperial postage, and the Imperial Institute should be briefly mentioned in this connection.]

VI. History.

First English colony (Newfoundland), formed in 1583. During Stuart period many colonies founded in America, owing to religious persecutions and civil war at home. Most of American colonies (United States) lost in 1776. Most of present British possessions founded since 1760. We have acquired possessions in various ways—

(1) **By conquest,** *e.g.*, Gibraltar from the Spaniards, and Cape Colony from the Dutch.

(2) **By cession,** *e.g.*, Hong Kong from the Chinese.

(3) **By purchase,** *e.g.*, Aden, Danish possessions on Gold Coast.

(4) **By settlement,** *e.g.*, Australia, Tasmania.

VII. Uses.

Four important purposes are served by our Foreign possessions. They furnish—

(1) **Homes** for thousands of British and Irish emigrants.

(2) **Trading Stations** for the collection and distribution of articles of British commerce.

(3) **Naval Stations** to shelter the fleets which protect our commerce and interests.

(4) **Halfway Houses** at which our ships may call to take in provisions, water, and coal.

Read 'C.R.,' Chapters 37 and 38.

LESSON XVII.—Our Relations with Foreign Countries and Powers.

Great Britain has relations with every established empire, kingdom, and republic in the world. She has no share in ruling $\frac{6}{7}$ of the land area of the earth, and she does not claim submission from $\frac{4}{5}$ of its population, but she is in constant communication with countries and peoples over which she has no governing power.

I. Nature of Relations.

These relations are of varying kinds, and may be classed as—

(1) **Commercial,** or trading relations. Trading firms in the larger towns of Great Britain have representatives not only in every part of 'Greater Britain,' but also in every civilized country of the world.

(2) **Philanthropic.** All civilized nations are agreed, for instance, that slave-trading should be suppressed, and almost all the civilized nations of the world act in unison with England in this matter.

(3) **Peace-preserving.** [Instance, Berlin and other conferences, the late conference in Paris on the Behring Sea Seal-fishing, etc.]

II. Extent of Relations.

Co-extensive with the world. English merchantmen are found in every important trade thoroughfare in the world, and in every important port. British merchandise on every important Continental railway. England's flag is known and should be honoured everywhere. These facts are due to—

(1) **The vastness of the Empire.**

(2) **Our enormous trade and numerous interests.**

(3) **Our desire for the advancement of the human race.**

(4) **Our love of adventure and enterprise.**

III. Maintenance of Relations.

Why is England, and especially London, the home of so many foreigners? Why do refugees and exiles from abroad seek our shores? Because they are always kindly and courteously treated. Why do we hear so much of 'pauper aliens' in our metropolis? Because, as a rule, they find it less difficult to live in London than in their homes on the Continent. British people have always, as a rule, treated foreigners both in Great Britain and abroad with—

(1) **Uniform courtesy.** Foreign ambassadors are always ready to acknowledge this. Generally, our countrymen have experienced the same courtesy from foreigners in foreign lands. We are capable of learning much from foreigners in the way of politeness.

(2) **Fair dealing.** This is characteristic of every Englishman worthy of the name. Uprightness, integrity, and justice in all our transactions with foreigners have earned for us a name in foreign lands. It behoves us to look to it that that good name is not forfeited by the practice of acts of meanness, injustice, or of actual fraud. Englishmen should not take advantage of the ignorance or the simplicity of savage or half-civilized races.

(3) **Friendly Feeling.** This can only exist where uniform courtesy and fair dealing are practised and recognised. Unselfishness is as valuable to a nation as to an individual. We ought not to inflict injuries on weaker races to secure advantage to ourselves. Friendly feelings are disturbed by acts of oppression and self-seeking.

IV. Officers Employed.

(1) **Her Majesty's Secretary of State for Foreign Affairs.** This official is generally a member of the House of Lords, and always a Cabinet Minister. He is at the head of all that pertains to our relations with foreign powers. He studies British interests in foreign lands, maintains friendly relations as far as possible, and arranges treaties and agreements with foreign courts.

(2) **Ambassadors** from foreign courts live in London to represent the powers which send them, and we have ambassadors at foreign courts to explain to them the wishes of our government and of our parliament. When a difference which cannot be amicably arranged arises between two countries ambassadors are recalled and war is resorted to.

(3) **Consuls.** British consuls or advising agents are found in every important port with

which Great Britain trades. Their duty is to look after British trade, to make trade returns to the government, and generally to make themselves useful to the British community where they reside.

Consuls General overlook other consuls, and **Vice Consuls** act for consuls in small places.

(4) **Envoys** are employed to carry out special treaties between England and foreign powers.

Read 'C.R.,' Chapter 39.

III. INDUSTRIAL AND SOCIAL LIFE.

LESSON XVIII.—Selection of Occupation.

The teacher should first pass briefly in review the subjects of previous lessons. Remind pupils that these lessons began with the consideration of the village, parish, or township in which they live as the starting point; that the study of local government has led up to that of central government; and that then it has been shown in the last two lessons to how much of the world that central government extends its powers and influence. In this and following lessons the pupil is called upon to consider himself as a unit—as *one* of the 350,000,000 people to be found in the British Empire; and he is called upon to learn how he can best fit himself for becoming a useful, active and effective member of that world-wide community to which he has the honour to belong.

In selecting an occupation, regard should be had to the following points, which may with advantage be talked over in and with the class.

I. Home Circumstances.

(1) **Parents** to be consulted, their (perhaps) advancing years to be thought of, and obligations to them to be unselfishly and ungrudgingly fulfilled.

(2) **Means** to be considered. Can parents afford to pay for apprenticeship? Will other members of the family suffer if great expenses are incurred for one? Is there a reasonable probability that, during the time that little is earned, discomfort or privation must be endured?

(3) **Surroundings.** If opportunities exist in neighbourhood of home for becoming an expert in any particular line, they should, other things permitting, be seized upon, *e.g.*, Polytechnic, Evening Continuation Schools, etc.

II. Bodily Constitution. The physique must be considered.

(1) **Health** must be suited as far as possible. Unhealthy constitutions cannot bear strain. Confinement in vitiated air altogether unsuitable to those with weak or unhealthy organs of circulation, etc.

(2) **Strength.** Occupations demanding great muscular strength should not be entered upon by those who are small and not well-developed.

III. Mental Qualities.

These as important as physical fitness. Occupations requiring intellectual capacity ought to be sought for those who are intellectually capable. Other mental qualities to be considered are:—

(1) **Eagerness in the pursuit of knowledge and skill,** which will develop into

(2) **Determination to become efficient,** and will result in the

(3) **Formation of high ideals,** as well as in the

(4) **Persevering use of every modern means of advancement.**

The presence or absence of these mental qualities should be considered in the selection of the work of life.

IV. Personal Tastes.

Without attaching too much importance to peculiar whims and youthful fancies, individual tastes should be consulted. Boys of a mechanical turn of mind should not be shut up to book-keeping in an office. The advantage of giving 'tools to the man who can use them,' and delights in using them is obvious. The inclination to manual work to be encouraged. Better be a capable artisan than a 'respectable' but half-starved clerk. A youth should not be forced to go on with work, or obliged to remain in a trade which is positively distasteful to him.

V. Importance of Choice.

Wise choice of a calling in life is of enormous importance, both to the individual and to the community.

(1) **The personal well-being and happiness** of the worker, and of all associated with him, depends upon whether he suits his work and his work suits him. A 'round man can never fit a square hole.'

(2) **The public usefulness** of the individual depends upon whether he is fitted to fill his place efficiently. If A is doing badly what B could do well, and A could do well what B is doing badly, the public usefulness of each of these individuals is less than it should be.

(3) **The success of the industry** is impaired by the appointment of individuals to offices which they cannot efficiently fill, *e.g.*, tailors and shoemakers who produce 'misfits,' etc.

Read Lesson 40 'C.R.'

LESSON XIX.—The Industries of the Country—their Growth and Development.

I. Classification of Industries.

The industries of Great Britain and Ireland may be classified as follows:—

(1) **Agricultural,** including pastoral.

(2) **Mining,** extending to metals and salt as well as to coal.

(3) **Manufacturing,** including the making of the simplest articles of commerce

II. Distribution of Industries.

(1) **Agricultural** and pastoral industries extend over the whole of the British Islands. Land that pays for cultivation is put under the plough

and made to produce cereals, root-crops, and market-garden produce. The last is much-needed in the vicinity of large towns. Land that does not pay for cultivation is used for pastoral purposes. Of 78,000,000 acres in the United Kingdom, 48,000,000 are under cultivation. Owing to the difficulty now experienced in growing corn at a profit, many acres are annually put under grass.

(2) **Mining** is carried on on all coalfields, and iron is usually found in the neighbourhood of coal-mines. Copper and tin are mined in Cornwall, and salt is plentiful in Cheshire.

(3) **Manufactures** are distributed over the country, but the staple industries are centralised.

III. Great Centres of Production. W. Riding of Yorkshire (woollen), S. Lancashire and Cheshire (cotton), S. Staffordshire and S. Wales (hardware), N. Staffordshire (earthenware), Nottingham (lace), Leicester (hosiery and boots), Northampton (boots and shoes). These are the greatest centres of production.

[Their position should be carefully indicated on the map, and the reasons why such centres have been chosen for manufacturing industries should be explained. Under the next head the connection of these centres with the centres of distribution should be carefully traced.]

IV. Great Centres of Distribution.

In a country where (1) so many mineral products are dug out of the earth; where (2) agricultural products are so many and so varied; where (3) tens of thousands of people live together in towns for manufacturing purposes, and require to have food, etc., brought to them; and where (4) so many more manufactured articles are produced than are required for the country's consumption—there must be centres of distribution. These we find in—

(1) **Inland Market-towns,** where agricultural produce changes hands.

(2) **Large Seaport Towns in general,** which export English manufactures and mineral produce, and take in foreign productions.

(3) **London in particular,** which is the centre of England's commercial transactions with the whole world.

V. Growth and Development.

A century ago England was not a manufacturing country of high rank. The population of the United Kingdom has more than doubled itself in this century, and at the present time the value of our export and import trade exceeds that of any other nation. Articles of English manufacture are known in every explored country of the world. This growth and development are due to the following causes:—

(1) **The richness of our mineral resources.**

(2) **The introduction of steam and machinery.**

(3) **The extent of our interests in foreign lands.**

(4) **The continued discovery of new markets.**

(5) **The British spirit of industry and enterprise.**

(6) **The continuance of uninterrupted peace with all nations.**

[All these causes should in turn be dwelt upon, and their relative importance made clear. It should also be pointed out that the commercial prosperity of any community depends upon the industry, the capacity, and the general character of the individual workers who constitute that community.]

Read Lesson 41, 'C.R.'

THE LONDON SCHOOL BOARD SCHOLARSHIP EXAMINATIONS.

THE annual examinations for the various scholarships at the disposal of the School Board for London were held in December. Competitors must be under 13 years of age, and must have attended public elementary schools in the district of the Board.

The preliminary examination was held at five centres on December 5th and 6th, and was attended by 193 boys and 111 girls. Papers were set for all the candidates in Arithmetic, English History and Modern Geography, and English Grammar and Composition; and an extra paper in Drawing for the boys, and exercises in Needlework for the girls. This stage of the examination was successfully passed by 79 boys and 40 girls.

The whole of these attended on December 15th and 16th, to take papers in special subjects at an Intermediate examination. Each candidate selected two subjects from the following list: Drawing (for girls only), Animal Physiology, Mechanics, Chemistry, Algebra, Euclid, Domestic Economy, Botany, French, Elementary Science. Latin, another possible subject, was not chosen by any candidate. Most of the girls did papers on Domestic Economy and French. The most popular subject among the boys was Algebra, and next to this the first three sciences named in the above list.

Nineteen boys obtained at least 70 per cent., and twenty girls at least 65 per cent. of the possible marks at the two examinations; and these were called up for an oral examination on December 22nd.

As a result of this testing, scholarships of £30 a year tenable for four years, have been awarded to four boys and three girls; two of £28 for the same time to one boy and one girl, and others of £20 a year, for three years, to two boys and one girl.

A supplementary examination of some of the boys and girls was held on January 9th to settle the award of certain other scholarships, called the Mitchell Scholarships, which are subject to local conditions. Seven of these have been awarded. All those children who were called up for the *viva voce* examination, but who for any reason were not able to take scholarships secured honourable mention.

Dr. Pinches, who has undertaken these examinations for the last three years, finds evidence of continuous and decided improvement in the work of the candidates. He suggests that, as the Scholarships are of sufficient value 'to allow the education of the holders to be continued in good secondary schools,' it would be well to exclude holders of other scholarships from the examination, so as to secure that as many children as possible may be admitted to the advantages of a higher education.

It should be added that the questions on the Laws of Health were given to determine the award of prizes offered to girls by the National Health Society.

For the information of our readers who may feel interested in these examinations, we are glad to be able to place the papers before them. To many they may be suggestive or stimulating, or at least useful for the practice of their pupils. To facilitate this use of them we have appended the answers to the questions in Arithmetic, Algebra, and the numerical examples in Mechanics.

QUESTIONS SET AT THE PRELIMINARY EXAMINATION.

ARITHMETIC.

Time allowed—3 *Hours.*

(*All the working must be shown.*)

1. Multiply six millions five hundred and eighty-three thousand and twenty by 6,309, and divide this product by 701. (*Answer in figures.*)

2. Add together 75 tons 3 cwt. 2 qrs. 10 lbs., 33 tons 1 cwt. 16 lbs., and 125 tons 2 cwt. 3 qrs. 2 lbs., and find the value of the whole at 5s. 7¾d. per quarter.

3. A cistern containing 60 gallons is one-third full; the supply pipe conveys into the cistern 2½ gallons a minute, and a discharge pipe lets out 1 gal. 3 qts. a minute.; if these two pipes are opened at the same time, in what time will the cistern be full?

4. How many yards worth 4s. 2½d. a yard must be given in exchange for 402 yards at 3s. 5½d. a yard?

5. If when meat is at 9d. per lb., it costs £20 to supply a family of 12 persons, how much will it cost to supply a family of 18 persons when meat is 1s. per lb.?

6. How many square yards of carpet will be required to cover the floor of a room 32 ft. long and 26 ft. broad?

7. Find (by Practice) the value of 5 lbs. 9 oz. 7 dwts. 12 grs. of gold at £3 17s. 10d. per oz.?

8. Simplify $\dfrac{4\frac{2}{5}+1\frac{1}{2}\frac{1}{2}-5\frac{1}{2}\frac{1}{5}}{6\frac{2}{7}\times 3\frac{1}{2}-\frac{2\frac{1}{5}}{\frac{2}{7}}+1\frac{2}{7}+1\frac{2}{5}}$.

9. Divide £89 17s. 6¾d. by 19¾.

10. Multiply ·0056 by ⅛ of 1·006; and divide ·0186 by ·0125.

11. Explain the rule for the reduction of a recurring decimal to a fraction. How can you tell by inspection that $\frac{1}{18}$ expressed as a decimal will be a recurrer?

12. If a cubic metre contains 1,000 litres, and a metre contains 39·4 inches, find the number of cubic inches in a litre.

13. Find the simple interest on £380 4s. 2d. from January 1st to April 30th, in the year 1892, at 4½ per cent. per annum.

14. What is meant by 'the present worth' of a Bill? Find the present worth of £252 19s. 3d. due 9 months hence at 4½ per cent. per annum.

15. I bought one pound of cinnamon for seven shillings, and sold half of it a 6d. per ounce; at what price must I sell the other half that the gain on the whole may be 10 per cent.?

16. At a paper-chase the hares had 20 minutes start, and ran the whole at the rate of 9 miles per hour. One of the hounds, who ran the same course at the rate of 10 miles per hour, arrived 8 minutes after the hares. How long was the run?

ENGLISH HISTORY AND MODERN GEOGRAPHY.

Time allowed—3 *Hours.*

1. Give in their order, with dates of accession, the names of the Sovereigns of England from 1603 to 1830.

2. Show, by a genealogical table, the descent of Edward IV. from Edward III. Mention three important events in the reign of each of these kings.

3. In whose reigns did the following persons live, and for what are they respectively famous:—Stephen Langton, Wat Tyler, Earl of Warwick (the king-maker), Thomas Cromwell, Walter Raleigh, John Knox, Christopher Wren, Horace Walpole, Horatio Nelson?

4. Give some account of three of the following:—Constitutions of Clarendon, Treaty of Troyes, Perkin Warbeck's insurrections, Ship Money, The Instrument of Government, Bill of Rights, South Sea Bubble.

5. State clearly, with dates, the causes, results and immediate consequences of the battles of Bannockburn, Bosworth, Blenheim, Quebec, Trafalgar, Waterloo.

6. What additions were made to the British dominions during the eighteenth and nineteenth centuries? Give some particulars of the circumstances under which these additions were made.

7. Explain the following terms, and give one example of each:—*isthmus, promontory, volcano, water-basin, cataract, delta, spring-tide.*

8. Explain the cause of Day and Night. Why, in summer, do the days lengthen as we approach the North Pole?

9. Where are the following, and for what are they noted:—Aberdeen, Cork, Swansea, Bristol, Munich, Odessa, Aden, Colombo, Port Elizabeth, Mauritius, Zanzibar, Khyber Pass, Peak of Teneriffe, Vancouver's Island, Falls of Niagara?

10. What articles does this country import to supply materials for clothing? From what countries are they respectively brought, and in what districts are goods manufactured from them?

11. What islands and island groups belong to the British Empire? State the position of each, and mention what use it is to this country.

12. Draw an outline map of Australia *or* South America, showing the chief physical features, political divisions, and positions of ten large towns.

ENGLISH GRAMMAR AND COMPOSITION.

Time allowed—3 *hours.*

1. Parse fully the following sentence:—

By crossing the river a little farther up, he got safely over.

2. Analyze the following passages:—

(*a*) 'Lives of great men all remind us
We can make our lives sublime.'

(*b*) 'Such were the sounds that o'er the crested pride
Of the first Edward scattered wild dismay,
As down the steep of Snowdon's shaggy side
He wound with toilsome march his long array.'

3. What is meant by *inflection, conjugation, tense, co-ordinate sentence?*

4. What is an *abstract* noun? What abstract nouns are derived from the words *young, child, thrive, hot, free, strong, friend?*

5. What two methods are there of comparing English adjectives? Write down the positive degree of *prettier, most, less, worst, first.*

6. What are *weak* verbs? Give the past tense (*first person singular only*) and the perfect participle of *come, bereave, eat, ride, swim, swing.*

7. Point out the effect of the prefix in each of the following words: *aboard, avert, antecedent, antiseptic, encourage, inveterate, inaccurate, gainsay, withstand.*

8. Give in your own words the meaning of the following passage:—

'Then rode Geraint into the castle court,
His charger trampling many a prickly star
Of sprouted thistle on the broken stones.
He looked and saw that all was ruinous.
Here stood a shatter'd archway, plumed with fern;
And here had fall'n a great part of a tower,
Whole, like a crag that tumbles from the cliff,
And, like a crag, was gay with wilding flowers;
And high above, a piece of turret stair,
Worn by the feet that now were silent, wound
Bare to the sun.'

9. Correct the following sentences, giving your reasons:—

(*a*) All plants do not bear flowers.
(*b*) I object to you doing it.
(*c*) She fell a-laughing like one out of their right mind.

10. Supply the requisite capital letters, stops, and other grammatical signs in the following passage:—

you are an englishman she exclaimed pray protect me from this man what is the matter was my natural enquiry he molests me because he is a coward she ran on and i am a defenceless woman oh take my part please it was evident that the girls excitement was not feigned.

11. Write a short essay on *one* of the following subjects:—

(*a*) The uses of electricity.
(*b*) 'A man is known by his company.'
(*c*) 'Honesty is the best policy.'
(*d*) The qualities which make a great man.

DRAWING. (BOYS ONLY.)

Time allowed—2 *hours.*

FREEHAND.

Candidates are required to copy in pencil carefully the printed example, increasing the height about two inches, and the width in proportion. No ruling or measurement of any kind is allowed.

[The example represented a design for a seat, with a shell for the back, scrolls for arms, and lion's claws for the feet. Its breadth as printed was about 7 inches, and its height about 5 inches.]

GEOMETRICAL.

1. Draw a straight line 2 inches long; parallel to this draw another straight line at a distance of 1 inch from it.

2. On a straight line, 1½ inches long, construct an isosceles triangle; the angle at the apex to be 30°.

3. Describe a circle with a radius of 1 inch; about this circle describe a regular hexagon.

4. Describe three circles, diameters, 2 inches, 1½ inches, and 1 inch respectively; each circle to touch the two other circles.

NEEDLEWORK.

Time allowed—2 hours.

Directions.

(*To be carefully read through by the Candidate before beginning work.*)

All calico marked A must be used for Exercise A; all calico marked B for Exercise B; and C for Exercise C.

Exercise A must be fully completed before Exercise B is begun, and no marks will be given for Exercise C, unless Exercises A and B are finished.

A. Fix and work a sew and fell seam of 5 inches, in cotton of two colours, so as to show a join in the cotton, both in seam and fell; turn down, and fix for hemming the four sides of the (joined) material.

B. Make a band. Sew a string on one end; make a button-hole the other end, and sew on a button in the middle.

C. Put in a calico patch 2 inches square.

QUESTIONS SET AT THE INTERMEDIATE EXAMINATION.

ANIMAL PHYSIOLOGY.

Time allowed—2 hours.

1. How would you prove that the air which you inhale differs from that you exhale? State what the differences are, and what gives rise to them.

2. What is the shape of the lower jaw-bone? How is it fastened to the skull, and how is it moved when you open and shut the mouth?

3. Explain how it is that the temperature of a warm-blooded animal is nearly constant, and show how this heat is generated.

4. Through what part of the body does the œsophagus or gullet pass? What is it made of, and what is its use?

5. Of what different parts is the skin composed, and how do they differ from each other? What are the most important uses of the skin?

6. How many ribs have you, and how are they moved?

7. What is the pulmonary artery? Where does it start from and where does it lead to? Describe its appearance.

8. What is gastric juice? Of what use is it in digestion?

9. Describe the structure of the ear. (*Diagram.*)

10. What is the medulla oblongata? What nerve-centres does it contain?

MECHANICS.

Time allowed—2 hours.

1. Enunciate the parallelogram of forces. Find the resultant of two forces of 10 lbs. and 8lbs. acting from the same points and inclined at an angle of 60°.

2. What is *momentum?* Compare the momentum of one ton having a velocity of one mile an hour, with one hundredweight having a velocity of 29 feet per second.

3. Define *velocity* and *acceleration.* A particle moving with uniform acceleration has, at a given instant, a velocity of 33 feet per second; eleven seconds later it has a velocity of one mile per minute. Determine the measure of the acceleration, a foot and a second being the units of length and time.

4. Masses of 5 lbs. and 3 lbs. balance each other at the ends of a lever 4 feet long; what is the position of the fulcrum?

5. Show how three movable pulleys may be arranged that a weight of 1 lb. may support a weight of 8 lbs., friction and the weight of the pulleys being neglected.

6. Find what horizontal force will be required to support a weight of 3 cwt. upon a smooth inclined plane, whose height is ⅔ of its length.

7. Define the *centre of gravity* of a body. Explain clearly why a body capable of rotating freely round a point is in unstable equilibrium if the centre of gravity of the body is above the point.

8. Define *specific gravity.* A cubic foot of water weights 1,000 ozs., and 288 cubic ins. of a certain substance weighs 128 lbs.; what is the specific gravity of the substance?

9. A rectangular tank is 12 ft. long, 7 ft. wide, and 2½ ft. deep; compare the pressures on the side and bottom of the tank.

10. Describe the forcing-pump. When the piston is raised why does the water come into the barrel of the pump?

CHEMISTRY.

Time allowed, 2 hours.

1. What is chemically pure water? How can impurities in water be detected?

2. On what principle is the metrical (French) system of weights and measures constructed? Give the units, under this system, of length and weight, with their English equivalents.

3. Define the terms *atom, molecule, analysis.*

4. What evidence is there that air is a *mixture* of gases, and not a chemical compound?

5. What are chief properties of the substance which is represented by the formula NO?

6. What are the properties of nitrogen? How can it be obtained from (*a*) atmospheric air, (*b*) ammonia?

7. A piece of marble is placed in dilute hydrochloric acid. Explain why it disappears, and state the change which the marble and acid undergo.

8. By what experiments could you show that hydrogen is a constituent of (*a*) hydrochloric acid, (*b*) ammonia?

9. What is a chemical equation? Give, in the form of chemical equations, the action of (*a*) sulphuric acid upon common salt, (*b*) sulphuric acid upon copper when heated.

10. What are the distinctions between metallic and non-metallic elements?

ALGEBRA.

Time allowed, 2 hours.

1. From a cask which did contain x gallons, a y-gallon measure has been filled n times, and also a z-gallon measure has been filled q times. Express algebraically the number of gallons remaining in the cask.

2. Add together $3a-2(b-c)$, $3b-2(c-a)$, $3c-2(a-b)$, and find the numerical result when $a=6$, $b=3$, $c=2$.

3. Find the continued product of
$$x^2-x-2,\quad x^2+2x-3,\quad x^2-x-6.$$

4. Divide x^4+4a^4 by $x^2+2xa+2a^2$.

5. Find the greatest common measure of
$$x^4-3x^3-2x^2+12x-8, \text{ and } x^3-7x+6.$$

6. Simplify $\dfrac{x}{2(x-1)}-\dfrac{x+2}{2(x+1)}$.

7. Simplify $\dfrac{ax-x^2}{(a+x)^2}\times\dfrac{a^2+ax}{(a-x)^2}\times\dfrac{a^2-x^2}{ax}$.

8. Extract the square root of
$$25x^2a^2-12xa^3+16x^4+4a^4-24x^3a.$$

9. Solve the following equations:—

(*a*) $\dfrac{4-5x}{6}-\dfrac{1-2x}{3}=\dfrac{13}{42}$.

(*b*) $ax+b=\dfrac{x}{a}+\dfrac{1}{b}$.

10. Find two numbers which differ by 4, and such that one-half of the greater exceeds one-sixth of the less by 8.

11. Solve the following equations:—

(*a*) $6x+2y-5z=13,\ 3x+3y-2z=13,\ 7x+5y-3z=26$.

(*b*) $9x^2-143-6x=0$.

(*c*) $x^2+y^2=185,\ x+y=17$.

12. Six horses and seven cows can be bought for £250, and thirteen cows and eleven horses can be bought for £461. What is the value of each animal?

13. A train travels 300 miles at a uniform rate; if the rate had been 5 miles an hour more, the journey would have been two hours less. Find the rate at which the train travels.

EUCLID.

Time allowed, 2 hours.

1. Define a *circle*, a *scalene triangle*, a *parallelogram*, and a *rectangle*. Write out *two* postulates.

2. From the greater of two given straight lines cut off a part equal to the less.

3. Two straight lines DF, NT, cut each other in the point Y. Prove that the angle DYN is equal to the angle TYF.

4. Prove that if two triangles have two angles of the one equal to two angles of the other, each to each, and one side equal to one side, viz., the side adjacent to the equal angles in each, the third angle of the one equal to the third angle of the other.

5. Describe a parallelogram that shall be equal to a given triangle, and have one of its angles equal to a given rectilineal angle.

6. Prove that in any right-angled triangle, the square which is described upon the side subtending the right angle is equal to the squares described upon the sides which contain the right angle.

7. Construct a square of which the diagonal CF is given.

8. If a straight line is divided into any two parts, prove that the rectangles contained by the whole and each of the parts are together equal to the square of the whole line.

9. Prove that if in any obtuse-angled triangle a perpendicular is drawn from either of the acute angles to the opposite side produced, the square of the side subtending the obtuse angle is greater than the squares of the sides containing the obtuse angle by twice the rectangle contained by the side upon which, when produced, the perpendicular falls, and the straight line intercepted without the triangle between the perpendicular and the obtuse angle.

10. Show that the difference of the squares of two unequal lines is equal to the rectangle contained by their sum and difference.

DOMESTIC ECONOMY AND THE LAWS OF HEALTH.

Time allowed—3 hours.

Domestic Economy.

1. Why are carbonaceous and nitrogenous foods so called? What different effects do they produce?

2. What are the principal animal products used as clothing? Point out their respective uses.

3. What is soap? Of what use is it in cleaning the skin?

4. How may water stored in cisterns become impure, and when in that condition how can it be rendered fit for drinking?

5. What are the most important substances contained in the tea leaf? How should good tea be prepared? What is its effect upon the system?

6. Describe the construction of a grate or stove that you would recommend for use in the kitchen.

7. Give directions for cleaning (*a*) furniture, (*b*) copper utensils.

8. Describe some economical way of cooking meat, and explain fully this process.

9. Mention the most suitable forms of nutriment for an invalid forbidden to take solids. Show how these should be prepared.

10. What are the principal machines used in washing? Point out the different purposes served by them.

(*For Candidates for the National Health Society's Prizes.*)

11. What is the composition of ordinary atmospheric air? State exactly how expired air differs from it. What are the effects of breathing over again air which has been already used for breathing?

12. Describe the intermittent system of water service. What are its advantages and disadvantages as compared with the constant supply?

13. State what points you would take into consideration in selecting a site for a house. How can a damp site be rendered dry?

14. What measures would you adopt to keep the air of a sick room fresh and pure?

15. How much air space and how much floor space per head would you provide for in a dormitory? Give the ground plan of a dormitory for twelve persons.

16. How would you treat (*a*) a severe burn, (*b*) a deep arterial cut, (*c*) an attack of croup?

BOTANY.

Time allowed—2 hours.

1. Of what parts is a leaf made up? What is the use of the leaf to the plant?

2. Describe the structure of the stem of a woody plant, and explain how it grows.

3. Describe the structure of the *stamen* of a flowering plant.

4. Explain why it is that plants droop on a hot day, and recover their freshness in the evening.

5. What are stipules? Describe the stipules of the Rose and of the Sweet Pea.

6. Explain the way in which insects are of use to flowers, and how they are attracted to them.

7. In what points of structure does a *seed* differ from an *ovule*?

8. Explain why it is that when a seed germinates the stem grows upwards and the root downwards.

9. Describe the flower of the Poppy, and the fruit of the Peach.

10. From what plants and parts of the plants are *Arrowroot*, *Caoutchouc*, *Tapioca*, *Sago*, and *Turpentine* obtained?

FRENCH.

Time allowed—2 hours.

I. Translate into English :—

1. Mon père a vendu sa montre et la mienne.
2. Pourquoi ne voulait-il pas répondre?
3. Vous avez tort de dire cela.
4. Voici de l'argent que votre frère a trouvé.
5. Au commencement de l'hiver de 1873, j'avais dix ans.
6. Ainsi mourut le plus religieux, le plus vertueux et le plus heureux des hommes, le seul peut-être qui pût dire, 'Je n'ai jamais, ni par mes paroles, ni par mes actions, commis la moindre injustice."

II. Grammatical Questions :—

1. When and why do you place the cedilla under the letter *c*?
2. Give the feminine of *beau*, *doux*, *pareil*, *bon*, *faux*, *long*, and put in the plural *cet imbecile de garçon s'est trompé!*
3. Why '*de* bonnes poires' but '*des* poires jaunes'?
4. Give the third person plural of the indicative future of—*avoir*, *parler*, *finir*, *recevoir*, *aller*, *pouvoir*.
5. Give some rules for the inflexion of the past participle.

III. Translate into French :—

1. Did you speak to your father's friend?
2. These three animals are more useful than all yours.
3. What reason did you give him?
4. You are thirsty, but I am very hungry.
5. There were some children before the house.
6. It will rain before five o'clock this evening.
7. He is not always at home on Saturday.
8. I was born on December 8th eighteen hundred and seventy-nine.

ELEMENTARY SCIENCE.

Time allowed—2 hours.

1. How do animals generally differ from plants: and how far do these distinctions hold in the lower animals and plants?

2. What are Mollusca? Distinguish the chief classes of these animals, and give examples of each.

3. What is the succession of plants observable in ascending a high mountain within the tropics?

4. What is the amount of the pressure of the air at the earth's surface? How can it be proved that this pressure is exerted?

5. Whence do we obtain *indigo*, *yeast*, *arsenic*, and *sulphur* respectively? What use is made of these substances in the arts or manufactures?

6. How is wind produced? What are the Trade-Winds?

7. Explain the construction and use of a thermometer.

8. Name four gases which are elements, and the properties of two of them.

9. What different kinds of lenses are there? What is the focus of a lens?

10. Explain the principle and working of some form of electric telegraph instrument.

DRAWING (GIRLS.)

Time allowed—2 hours.

FREEHAND.

Candidates are required to copy in pencil carefully the printed example, increasing the height about two inches, and the width in proportion. No ruling or measuring of any kind allowed.

[The example represented the curved head of a bishop's crosier with leaf ornamentation. Its length as printed was about 7½ inches, and its breadth nearly 4 inches.]

GEOMETRICAL.

1. Draw a straight line perpendicular to another straight line from a given point without it.

2. Inscribe in a circle of 1 inch radius a regular heptagon.

3. Describe a circle of 1½ inch diameter, take any point 1½ inch from the centre of this circle, and from it draw a tangent to the circle.

4. At one extremity of a straight line 2 inches long, draw another straight line, making an angle of 105° with the first; these are the adjacent sides of a parallelogram: complete the figure.

ANSWERS TO ARITHMETIC QUESTIONS.

1. 41,532,273,180; 59,247,180.
2. 233 tons 7 cwt. 2 qrs.; £5,270 7s. 8½d.
3. 53⅓ minutes. 4. 332 yards.
5. £40. 6. 92 sq. yds. 4 sq. ft.
7. £269 19s. 8½d. 8. $\frac{22}{3511}$.
9. £4 11s. $0\frac{55}{66}$d. 10. ·0007042; 1·48.
11. One of the prime factors of the denominator is 7. If the fraction is equivalent to a terminating decimal, its denominator, when in its lowest terms, will have no other prime factors than 2 and 5.
12. 61·162984 cub. in. 13. £5 13s. 5½d., or £5 12s. 6d., according as both dates are included, or only *one*.
14. £245. 15. $5\frac{1}{2}\frac{1}{6}$d. per oz. 16. 18 miles.

MECHANICS.

1. 15·6205 lbs. nearly.
2. As 88 : 87. 3. 5 ft. per second.
4. 18 inches from the larger weight.
6. 201⅓ lbs.
8. 12·288.
9. As 28 : 5.

ALGEBRA.

1. $(x - ny - qz)$ gallons.
2. $3a + 3b + 3c = 33$.
3. $x^6 - 14x^4 + 2x^3 + 47x^2 - 12x - 36$.
4. $x^2 - 2xa + 2a^2$.
5. $x^2 - 3x + 2$.
6. $\frac{1}{x^2 - 1}$. 7. 1.
8. $2a^2 - 3ax + 4x^2$.
9. (*a*) $x = \frac{1}{7}$; (*b*) $x = \frac{a - ab^2}{a^2b - b} = \frac{a(1 - b^2)}{b(a^2 - 1)}$.
10. 18 and 22.
11. (*a*) $x = 2$, $y = 3$, $z = 1$; (*b*) $x = 4\frac{1}{3}$ or $-3\frac{3}{4}$; (*c*) $x = 4$ or 13, $y = 13$ or 4.
12. $x = £23$, $y = £16$.
13. 25 miles per hour.

MODERN EDUCATIONAL REFORMERS.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),
Author of 'Mental Science and Logic for Teachers.' Late Director of the Birkbeck Training Classes and Lecturer therein on School Method.

No. VIII.—A QUAINT OLD BOOK ON TEACHING. (A.D. 1705.)

THE Educational Library and Reading Room attached to the South Kensington Museum is a happy hunting ground for the modern teacher, who would fain see how men's minds were moved with respect to education in the distant past. Many a time and oft have we revelled in rummaging amongst the quaint old books which record the little that English thought produced in constructive education way back in the fifteen, sixteen, and seventeen hundreds; and in the course of one of these desultory excursions to the realm of 'has been,' we happed upon the book now under discussion, the title of which is as follows: 'An Essay upon the Necessity and Excellency of Education, with an account of erecting the Royal Mathematical School by Mr. Maidwell.' The book is dedicated, in the fulsome manner of the times, to 'The Right Honorable Robert Harley, Esquire, Speaker of the Honorable House of Commons, One of the Principal Secretarys of State and of Her Majesty's Most Honorable Privy Council,' and bears the date 1705 upon its title-page. Worthy Mr. Maidwell seems to have been much exercised in spirit as to the non-practical nature of the education then in vogue in merry England, and he endeavours with success to remedy this in so far as concerned the paramount interest to insular Britons—to wit, the manning and conduct of the navy. But the most interesting part of the work is that which deals with the 'necessity and excellency of education.' Speaking of the 'Little Parish Nurserys,' the author complains that they educate too many poor scholars who turn up their noses at trade, and 'having lap'd Letters as dogs drink the *Waters* of the *Nile*, conceit themselves above the employment of a Shop, and thence become the Scandalous Interlopers and Quacks of Nobler Professions. These *Petty Scholes* might be made Beneficial to the Commonality, if they were circumscrib'd in proper limits, not to teach beyond *Correct Reading*, and *Fair Writing* with *Arithmetic* and some Branches of *Mathematics;* which method wou'd qualify them for most Trades, and by industrious Ingenuity advance them to several Stations of Credit by *land* and *Sea*.'

In his desire to unloose the purse-strings of Patrons and Benefactors, Cicero is quoted by worthy Mr. Maidwell: 'That Great Fortune can do nothing *Greater*, nor Good Nature *Better*, than to do Good to as many as possible'—a pronouncement with which nobody will quarrel in these days of Utilitarianism, and which seems to have answered the desired purpose. But we pass on from the Preface to the essay on 'the Necessity of Education.' The opening paragraph supplies us with a key to the author's views on this part of his subject. 'Education, which is the Acquisition of Arts, and Sciences, for the Support and Advantage of Life, was decreed by our Creator in Paradise, and is the Fatal Consequence of the Punishment inflicted upon Our First Parent, as his Sentence of Expulsion testifies.' The old familiar saw that Necessity is the mother of invention was evidently in the mind of the old-time educationist when he penned the following lines:—'Without contradiction the Dayly Necessitys of Life make Education most necessary. Without it Life could not subsist, and this Universal Truth continues from the Beginning to the End of the World. Mankind will ever remain a Debtor to Poverty, and the Heathens esteem'd Her amongst their Deitys for her Useful Sagacity. In the poet Aristophanes She arrogats to Herself the Invention of the Sciences, and Xenophon cals her Wisdom without a Master. In Theocritus She alone incites Arts and teaches Labor, which Sentiments Virgil has paraphras'd in his Georgics. Necessity is termed by Heliodorus the Contriver of Designs, and in the Epigram boldly

taught the Lame and Blind to supply their Defects. The Graces number'd Periander amongst their seven wise men for this Apothegm *Care performs al things*, and their Adage, of the Gods felling nothing without Labor, is become a Proverb of every Nation.' He closes this section with an epitome of Socrates' tale concerning 'Sloth and Virtu,' the latter of whom exhorted Hercules in the following words:—'If he would be Eminent in any Imployment, Civil, Military or Rural, He must be Laborious and Beneficial. That Idleness is the Hatred of the Gods and Good Men, never seen nor spoken of without Scandal.'

As to the 'Excellency of Education,' we learn that 'Education bruises the Serpent's Head, and restores Man to his Primitive God-like Image. By that we may know Good and Evil without Danger; by that Man becomes the Rational, Prudent, Useful Creature, and like Afflicted Job receives twice as much as he had before. . . . . If Life and Death are set before Us, whilst we tread this stage of trial, we are enabled beyond doubt by Education to make an Happy Choice, for the same *Hebrew* Word in Scripture denotes the Fool and Sinner.' To enforce this position and make it unassailable, Plutarch is quoted, as thus: 'That other Gifts are Corporeal, Little and not Worth Our Affections; Nobility deriv'd from our Ancestors, Riches in the Possession of Fortune, Honor Unconstant, Beauty Shortlived, Health mutable, Strength Obnoxious to Sickness, or Old Age. Only Learning is Immortal and Divine, Plac'd above Fortune's Power and cannot be forc'd away by Calumny, Corrupted by Sickness or Injur'd by Age.' And by way of a clincher we get a quotation from Cicero to this effect:—'Her Pleasures and Profits are Everlasting, They exercise Youth, rejoyce Old age, adorn Prosperity, support and comfort Adversity, please at Home, and are no impediment Abroad, they Lodg with you, Travel with you, and keep you Company in your Rural Recess.'

Mr. Maidwell next reads parents a lecture upon their duty with regard to the education of their progeny, a task which we teachers have much too frequently to perform in these latter days. 'Al Parents are most strictly oblig'd to Cultivat their Childrens Education. Nature, by the Statute of Retaliation, requires exact Obedience to her Law; it being most Righteous for Parents to do justice to their Children, as Good Parents have done to Them; otherwise they Cannot Expect the Honor of the 5th Commandment. . . . . The damage done to the Commonwealth (by neglect of this duty) mov'd *Aristotle* to determin that Parents who have taken care of their Children's Education are far more honorable than those who only beget Them; for These are but Accidental Authors of their Living; Those of living wel; meriting double Honor by being Parents of their Minds as wel as Bodys. And so venerable to Antiquity was the Remembrance of this Affectionate Regard to Youth that *Alexander* profess'd Himself more Engag'd to his Master *Aristotle* than to his Father Philip,' an Arcadian state of affairs now fallen into sad desuetude, and which it would be meritorious to resuscitate.

The vexed question as to whether a public education is to be preferred before a private one is next dealt with at some length, the predilection of Mr. Maidwell being entirely in the direction of the former, full importance being rightly given to the invaluable education which comes from the reaction of Society upon the individual, for, as our educationist quaintly observes, 'Yet suppose Him Learned and wel Bred, the solitude of a Chamber can never æqualise the vivacity of Society. Fruit does not ripen wel in the Shade, and at Home the Boy learns only what is taught Him, in a Schole what are taught Others. There Every Day He hears many things commended, and many corrected reaps an Advantage, by the Shame of this Lad's Idleness and the praise of the Others Industry. Commendation provokes Æmulation, and he will think it dishonorable to yield to his Æquals and glorious to excel his Seniors.'

The following quotation is not inapt at the present time, when the London School Board does not think shame to saddle a single master with the impossible task of training eighty or even a hundred children. 'Lastly, to remove the Principal Objection, that by reason of too many Scholars, some will be neglected, Quintilian is Positive that no Good Educator should, or would burden himself with a greater Number than he can wel manage.'

Unfortunately the good educator may be burdened with too many scholars, by the crassness and folly of his so-called economical masters, whatever good Mr. Maidwell may to the contrary say.

With regard to special training to suit special ability, we have some very pithy and pregnant remarks, as thus: 'The Inclination of the Mind towards One Occupation of Life more than Another is Essential to Human Nature, and appear'd in the World, as soon as Man was fit for Observation and Labor. . . . . Upon Consideration we find this difference of Tempers to arise from Providence and the Law of the Creation, and to be Evident in al Irrational and Inanimat Beings. Whose Perfection is visibly appointed One Way, and if you press the Opposition of this Nature, you destroy it. Every Man feels in himself the same Impuls of Application, and tho by the vast Comprehension of his Soul, at first diverted with a general knowledge of Objects and Sciences, yet soon chuses one to be his Favorit, and after the Gallantry of Conversation with several, settles and Marrys Her, as his Faithful Assistant to alleviat the Cares of Life.'

'As the various Necessitys of Life demand help from Variety of Arts and Sciences, so diversity of Arts acquire diverse Artificers; and One Man is no more design'd for Al Arts, than Al Arts for One Man. We are born Confæderats, mutually to help One another, therefore appropriated in the Body Politic, to this or that busyness, as our Members are in the Natural to perform their Separat Offices; And since Art is long, and Life short, Nature deals kindly with us, by planting this Single Propensity in Our Hearts; for, alas, why should Mortals prætend to Execute many Gifts, who have scarce Time allotted to finish One. . . . . It is in vain to swim against the stream and as Bodys by the *Canon* of Nature tend to their Proper Center, so the Facultys of the Soul move best in their Natural *Vortex*. This the Gravest Philosophers experimented, and tho bred, and exercised in distant Imployments were always uneasy in their thoughts, til they fel into the Course of Life Apposit to their *Genius*.'

The remainder of the book is occupied with the lives of Cicero and Plato as exemplars, and with a dissertation upon Naval Instruction, up to which of course the foregoing was intended to lead, finally concluding with a Syllabus or Curriculum which the worthy fellow thought should be followed in the Naval and Mathematical School which he was the means of creating. That the author's design was, as he endeavoured to show, the promotion of the public good, no one will for a moment doubt. We append the Syllabus as given by Maidwell:—'*A Scheme of Learning Propos'd to be Taught* in the Royal Schole, *for the Real Improvement and Advancement, of Useful Navigiaton.*

'I., Geometry; II., Arithmetic; III., Algebra; IV., Mechanics; V., Statics; VI., Hydrostatics; VII., Surveying of Land; VIII., Fortification; IX., Perspective; X., Drawing; XI., Trigonometry; XII., Practical Geometry; XIII., Use of Globes and Spheres; XIV., Mapps and Sea-Charts; XV., Astronomy; XVI., Calendars; XVII., Geography; XVIII., Architecture Civil and Naval; XIX., Promiscuous Learning (languages and anything likely to make the sailor more intelligent with respect to foreign nations).'

That this side-light from the past may be appreciated to the full, it is to be remembered how few have been the Englishmen who, even up to modern times, have thought education worthy of thought. Although Mr. Maidwell was not very profound, earnestness—that sublimest of all gifts—must be conceded to him without hesitancy; not a few of us will be prepared to go further and to apportion a meed of gratitude to this worthy, who nearly two hundred years ago discoursed so eloquently upon the necessity and excellency of education and upon the duty of parents in this particular. Hence no apology is needed for introducing our readers to this quaint book, with its solid belief in the reforming efficacy of education; and we may also observe, with truth, that, in studying so closely what Plato and Aristotle and Socrates and Cicero and Quintilian have had to say upon education, he, layman though he was, has put those of us to the blush who by our actions testify that, if, like Robert Lowe, we do not doubt the existence of a science of education, we do persistently refuse to ascertain what history has to tell us with regard to this science. With the earnest wish that this culpable neglect may soon be numbered with the things that have been, we bring our pleasant task to a conclusion.

SCIENCE NOTES.

Black Diamonds.—Attention has been called in these columns to the interesting attempts of M. Moissan to form diamonds artificially. Recently he has succeeded in obtaining black diamonds which occur very rarely in a natural condition. Certain specimens of a transparent black variety of carbon obtained by him present a decidedly crystalline appearance. They scratch the ruby, resist the action of potassium chlorate and fuming nitric acid, and burn in oxygen at a temperature near 900° to produce four times their weight of carbon dioxide. In all these respects they accord precisely with natural diamonds which possess exactly similar properties.

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The Action of Fluorides on Yeast.—Effront has shown that yeast cells can be gradually accustomed to the presence of large quantities of ammonium fluoride, and even develop more freely, as well as become capable of fermenting relatively larger proportions of sugar. M. Sorel has lately been conducting experiments with the view of adding to these results. While yeasts accustomed to live in a medium rich in hydrofluoric acid are found to form new cells very slowly, when they are removed to a weaker medium their activity becomes very great, new cells forming with such rapidity that it is impossible to count them. This activity would seem to increase in proportion as the original medium is charged with aseptic matter. M. Sorel found also that repeated treatment with increasing proportions of hydrofluoric acid failed to destroy the power of reproduction in the yeast cells.

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An Electric Indicating Thermometer.—An ingenious application of electricity has been adopted as an aid in preserving a constant temperature during laboratory operations. An ordinary mercurial thermometer has the upper half of the stem somewhat enlarged in diameter, the lower narrow portion being alone graduated. A fine platinum wire (i) is sealed into the bottom of the bulb so that one end projects into the mercury, and a similar wire (ii) is fixed into the upper part of the stem, running the whole length of the thickened portion. A third platinum wire (iii) extends from a point about one-third the distance down the narrow graduated part of the stem, up past the free end of the second wire as far as the middle of the latter, round which it is then twisted in a spiral, a steel needle to serve as an index being soldered to its extremity. The air in the upper part of the stem is replaced by orthotoluidine, a substance which boils at 200°, freezes at — 20°, and does not appreciably affect the mercury. The opening is then sealed, and the thermometer fixed in a suitable copper frame, the lower part of which may readily be introduced into the openings in drying-ovens, &c. A small permanent horseshoe magnet is next placed so that its poles are opposite the ends of the index, which it maintains in position by its attractive influence, so that the moveable wire (iii) becomes practically a prolongation of the fixed wire (ii) along which it slides by means of the spiral. By sliding this magnet up or down the side of the thermometer tube a corresponding movement of the wire (ii) also takes place. The free extremities of the wires (i) and (iii) are attached to binding screws which are in turn connected with an electric bell and battery. Now, when the surrounding temperature is sufficiently high to expand the mercury until it comes in contact with the lower extremity of the wire (iii) the circuit is immediately closed and the bell rings; and by regulating the position of the permanent magnet, and consequently the steel index on the upper end of the wire (iii), it is possible to fix the maximum temperature at any point desired.

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The Influence of Solvents on Germicides.—As long ago as 1881 Koch drew attention to the fact that the liquids employed as solvents of carbolic acid sometimes affect its properties as a germicide. P. Lenti, of the University of Naples, has recently undertaken a course of experiments demonstrating that absolute alcohol completely neutralises the germicidal action of both corrosive sublimate and carbolic acid with regard to anthrax spores, and that a considerable proportion of water must be added before any germicidal action can then take place. Glycerine impedes the action of sublimate when less than forty per cent. of water is present, and of ten per cent. solutions of carbolic acid, when they consist of less than eighty per cent. of water. Carbolic acid and lysol also lose their disinfecting property entirely when dissolved in olive oil. It would seem, therefore, that alcohol, glycerine, and fatty bodies are not suitable ingredients of liquid disinfectants.

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The Metric System in America.—It is stated that the United States Bureau of Weights and Measures has decided to use the metre and kilogramme as fundamental standards, and from the ensuing fifth of April to consider the yard and pound as derivatives from the metrical standards.

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A Vanished Continent.—Mr. Henry Forbes from the law that 'the areas inhabited by a given species, and in considerable measure likewise by the same genera, are or have been continuous with each other,' argues the existence of a vanished southern continent, which he would term Antarctica. The boundaries of this continent, he thinks, would have joined Patagonia, New Zealand, Tasmania, with East Australia, and the old island-continent, which Dr. Sclater named Lemuria, to a circumpolar land greater than at present by extensive independent peninsulas between which the Atlantic, the Pacific, and the Indian Oceans extended almost as far south as they do now.

COLOUR-TEACHING IN SCHOOLS.—The psychology of colour sensations, laws of contrast, harmony, etc., is now being adopted as a school subject in America. It is proposed to teach the children, with whom this subject is very popular, single colours, colour relations, combinations of colours, contrast, sensitiveness to colour harmony.

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DRY BREAD AS A DISINFECTANT.—In Berlin bread-crumbs are being employed as a means of disinfecting houses. In the first place every thing that can be subjected to steam is removed without detriment to the disinfecting station; then all the things are removed from the walls, which are rubbed with bread. Ordinary German loaves, forty-eight hours old, are used for this purpose. They are cut into substantial chunks about six inches square, the back of each piece consisting of the crust. The walls are then rubbed in a downward direction with the bread, and the crumbs are swept up and burned. The walls are then thoroughly sprinkled with a five per cent. carbolic acid solution; the floor is washed with a weaker carbolic acid solution, and polished woodwork and ornaments receive the same treatment.

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FOREIGN SUMMER SCHOOLS.—In view of the fact that full courses both of class instruction for beginners and of lectures in the history and literature of the country, for more advanced students, will be held both at Jena and at Caen in August of the present year, it is interesting to note that the summer school held last summer at Jena was attended by twenty-seven English teachers, one-third of whom were women. The objects aimed at were good elementary instruction by skilled teachers, the teaching German from life, and association with German schools circles. The school was entertained by the University of Jena, and as women there are forbidden entrance in university rooms, the professor, whom the women teachers wished to hear, lectured in another building. Dr. Spence, of Bangor, is the chairman of the committee of arrangement, and it is proposed to invite German teachers to England on a similar plan.

PAPERS FOR PUPIL TEACHERS.

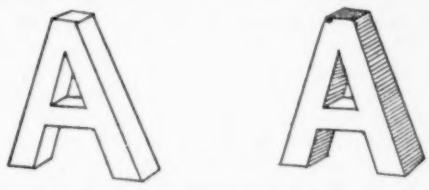
BY JOHN ADAMS, M.A., B.SC., F.C.P., ETC.
Principal, Free Church Training College, Aberdeen.

BLACKBOARD DRAWING.

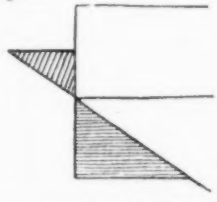
SOME people say that pupil-teachers are very conceited. Such people do not take a sufficiently wide view. If they want to know how really modest the average pupil-teacher is, let them ask him to draw something on the blackboard. Speaking generally, the pupil-teacher regards this as quite out of his province. To write on the blackboard, and even to copy a map on it, well and good; but to draw on it is to expect too much—that is the sphere of genius.

While it must be admitted that a good blackboard draughtsman is, on the whole, a much rarer person than a first-class artist in oils or in water-colours, it may be safely asserted that everyone of you can draw quite well enough to render your blackboard really serviceable. For it very fortunately happens that the only kind of drawing that is really useful on the blackboard is just the kind that is easiest for indifferent draughtsmen.

Artists never tire of telling us that in nature there are no such things as hard outlines; in blackboard drawing there should be nothing else. Everything should be shown there by bold lines. Shading is never very successful on the blackboard, and in the hands of the unskilful leads to ridiculous results. To shade rounded objects correctly is a work demanding much skill and no little time, and for the latter reason, not to speak of the former, should never be attempted in teaching. On the other hand, a plain flat shading, either by diagonal lines or by filling in with the flat of the chalk, often gives a distinctly more intelligible look to a solid object. Compare, for example, this unshaded A with the shaded one.

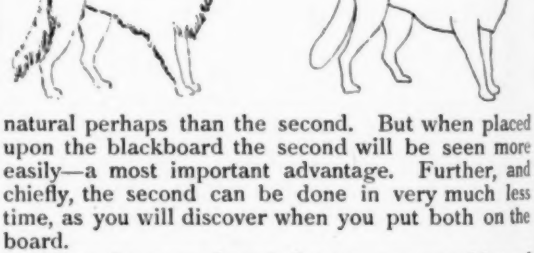


Here the effect is very great, and the expenditure of time very little. The value of this style of shading is naturally more apparent in the case of objects unknown to the pupils.



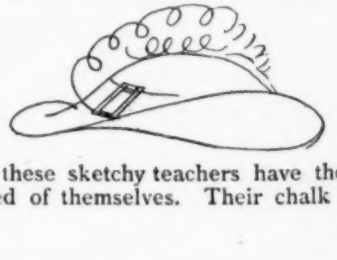
Take, for example, this sketch of what are called the co-ordinate planes in solid geometry. No one can fail to see what an advantage there is in the rough shading there used. But if anyone is a little doubtful, let him turn to the figures in Euclid, Books XI. and XII., and he will readily appreciate the disadvantages of the lack of shading.

Next, the use of broken outlines is objectionable on pretty much the same ground as that of elaborate shading. Copy on a blackboard, for example, the two dogs here given. The first looks a little more



natural perhaps than the second. But when placed upon the blackboard the second will be seen more easily—a most important advantage. Further, and chiefly, the second can be done in very much less time, as you will discover when you put both on the board.

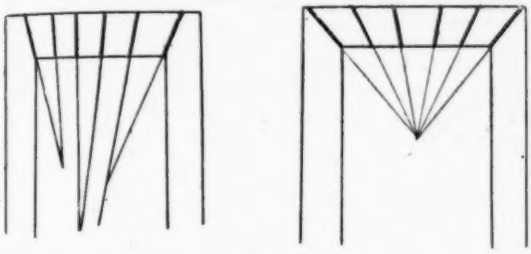
It is to be remembered that we are speaking of our blackboard as used in presence of a class. Hence our urgency in seeking speed. Everything but clearness must be sacrificed to this; only, clearness must not be sacrificed to anything whatsoever. Some teachers have a fatal habit of 'dashing off' what they are fond of calling 'a sketch' on the blackboard. Talking of the cavaliers' hats and plumes, they knock off something like this:—



Usually these sketchy teachers have the grace to be ashamed of themselves. Their chalk flourishes

so much in the air before it descends upon the board, that they feel that the performance is not quite up to the swagger. Accordingly the work is accompanied by a running fire of apologies—'This is only a sketch, you know.' 'Of course, it isn't really like this, you know, at the end, the lines should meet there.' 'If this were correctly drawn, you would see the feather much higher,' &c., &c.

In the accompanying illustration of a 'flat arch,'



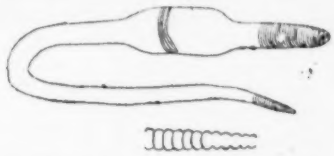
for example, such a teacher will say that 'All those lines should meet in the one point; they don't here, but it's just a rough draft.' Instead of drawing the thin lines down *after the arch was made*, to test if it was right, the teacher ought to have drawn them while constructing the arch, and thus ensured that it would be right. Above all he ought to have held his tongue about his bungle.

There are three 'No's' in blackboard drawing: and one of them is 'No apologies.' Even in ordinary life 'Never apologise' is excellent advice, but in teaching it is imperative. If you have done something morally wrong, apologise by all means, but when you are simply clumsy and unsuccessful the less said the better. Children are very apt to take you at your word. When you say 'those lines should meet in a point,' they are quite willing to believe you; only, they want to know why you didn't make them meet. The only reasonable apology the sketch draughtsman can offer is for his moral delinquency, as thus: 'Well, boys, that's very badly drawn. To be sure I could have done it much better. But then I am lazy and careless. I hope you'll excuse me this once, I'll do better next time.'

Nearly as bad as the sketcher, but in quite a different way, is the painfully conscientious draughtsman, who puts in every line that the most exacting object can demand. To illustrate a pigeon's tail, for example, he draws something like this—

and fills up each feather with the herring-bone shading shown in the two middle feathers. Meanwhile the class has to find its own amusement.

The accompanying sketch of an earth-worm is as complete as there is any necessity for; but your conscientious draughtsman is not content till he has put in all the rings (somebody has done the worm the honour of counting them—they number 400). In fact the really conscientious man puts in the outline in indented lines, like the little drawing below, and



spends the rest of the hour in joining the opposite indentations. In all cases of this kind a few specimen lines are all that is required—anything more is sheer waste.

The next 'No' is 'No straight-edge.' Nothing is more deplorable than the helplessness produced by dependence on mechanical aids in drawing straight lines. An exception may be made in favour of certain rapid aids to be spoken of later, and perhaps it may be allowed that in teaching geometry a square may be used, but in all other cases the expenditure of time utterly condemns the straight edge. No teacher can fail to draw a line sufficiently straight for his purpose in a fifth part of the time he would take to get his straight-edge placed.

To complete the three 'No's' we have 'No duster.' In practising blackboard drawing it is good to 'wipe out' as often as you like, but once you are before your class you have no time to 'try back.' Each line must stand as the chalk leaves it.

In olden times people wrote on wax tablets with the sharp end of a metal instrument called a 'style,' and when the writing was of no further use, they obliterated it with the blunt end of the style, which Horace slyly calls the 'better part' of it. In blackboard drawing this sneer is misplaced. Even in ordinary drawing on paper india-rubber does much harm by presenting a too easy remedy for bad work, and the blackboard introduces the additional disadvantage of wasted time.

'No duster' must be held to include 'no wet fingers,' for if the duster is bad the objectionable habit of doing its work with a couple of wet fingers is much worse. As soon as the board is wet, it becomes quite impossible to put any line beside the wet part, unless we are content to have a smudgy line—to say nothing of the ugly white stain which cannot be removed by using the ordinary dry duster.

If complicated pictures had to be drawn, it would be impossible to attain to this offhand drawing; but complicated pictures are precisely what are not wanted to any appreciable extent. The two kinds of drawings of real use in blackboard drawing are diagrams and simple pictures of objects.

The difference between the two classes is, that the picture tries to represent the object exactly as it appears, and in as full detail as possible; the diagram, on the other hand, makes no attempt at preserving actual appearances, and contents itself with representing one or more qualities separate from all others. A picture of the earth, for example, would represent it as it might appear to a spectator looking at it from some distance, and would require to show the shapes and sizes and real appearance of all the objects on the earth. A diagram of the earth, on the other hand, may show nothing more than its shape and the inclination of its axis.

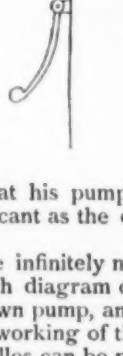
This is a very suitable place to impress on the

young teacher the important fact that the *simple* is not the same thing as the *easy*. In fact, it may be very much the contrary. A diagram is simple, a picture complicated, yet the picture is usually much more easily comprehended by the pupil. The cause of the difference is that in the diagram we have a quality, or a few qualities, separated from the object, and therefore abstract, and difficult to grasp in their relations; whereas in the picture we have each thing just as it appears in nature. We do not know the details in the picture, but we know the general effect; in the diagram we lose the general effect in order to gain a complete knowledge of certain details.

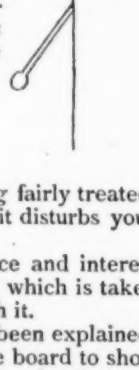
For simple pictures of common or non-complicated objects the blackboard is remarkably well suited. A trowel, a garden-roller, a smoothing iron can be all easily and effectively put on the blackboard, where they are of immense service in giving clear ideas to those who have not seen the real objects.

But it is in diagram that the board is really most useful. If the diagram is to be complicated and carefully worked out, it should be done on paper and preserved. But there are two kinds of diagrams for which the blackboard is specially well suited. The one is when you have a certain fixed object to explain. Suppose, for example, that you have to explain the working of the pump in the school playground. You may have an admirable printed diagram hanging on the school walls illustrating the general principle of the pump. But your pupils want to have nothing to do with a general pump. What they are interested in is their own pump. The differences may be trifling, but to a child they seem considerable enough to make

The real pump handle may be like this—



The diagrammatic one like this—



him think that his pump is not being fairly treated. and insignificant as the difference is, it disturbs your pupils.

They have infinitely more confidence and interest in your rough diagram on the board, which is taken from their own pump, and agrees with it.

Once the working of the pump has been explained, various handles can be placed on the board to show that the shape is immaterial. But for the first explanation the existing handle is emphatically the best.

The second class of diagrams for which the blackboard is specially suited, includes those which require the conditions to be changed during the course of the demonstration, A duck may be drawn with its legs in the walking position—then water may be drawn in, and a new pair of legs added in the swimming position. So in the plan of a battle, for example, we may begin with nothing but the natural features of the place—the hills, valleys, towns, and rivers. Next the opposing forces are indicated as at the beginning of the fight. By and by the forces have quite changed their positions, and this change can be readily represented on the blackboard, while the printed chart can only represent one definite point in the battle.

The same advantage is still better seen in the case of a diagram in which there are alternative cases, say in a diagram of the eclipses. By keeping the earth between the sun and the moon, we have an eclipse of the moon; by simply placing the moon between the sun and the earth, we have an eclipse of the sun. To represent this in a printed form we require two diagrams, which tends to produce confusion in the child's mind.

In our next article we shall treat of the place of mechanical aids in blackboard drawing, and the best way of turning them to account.

EXERCISES IN FRENCH FOR CERTIFICATE EXAMINATION.

The Syllabus for Residential Training Colleges for 1894 states that the French paper in the Certificate examination of First Year Students 'will contain grammatical questions, and easy passages for translation *from* and *into* English;' and that that of Second Year Students 'will contain more difficult passages than those for students of the First Year, for translation *from* and into English *prose*, with questions upon the construction of particular sentences.'

I.—French-English Sight-reading Tests.

As these tests constitute the most difficult and important part of the French papers, it is proposed to supply our readers each month with passages taken from good French authors, and varied in vocabulary and style, with a view to stimulate and test preparation in this part of their work. The exercises will be carefully graduated, and will increase in difficulty each month. There will be two sets—one for First Year Students, and another for Second Year Students. Occasionally portions of the passages will be italicised, and such portions will be translated, and the peculiar constructions commented on and explained in the following month.

Students are recommended to attend to the following instructions:—

(*a*) Look through the whole of a passage before attempting to translate any part of it.

(*b*) Do not look *for the meaning of any word in the dictionary* until you have quite decided you cannot conclude from the contents the meaning of the word or words in question.

(*c*) Do not *guess* the meaning of a word; it is much better to leave a blank than insert a wrong meaning.

(*d*) Be sure not to write nonsense; if your translation is nonsensical, you may safely conclude that you have not caught the sense of the passage.

(*e*) Seek to acquire as extensive a vocabulary as possible.

That students may judge somewhat of their present state of preparedness for this part of their work, we give the passages set last Christmas.

A.—*First Year Students.*

Translate:—

Le roi cependant, la reine, madame Elisabeth, et les enfants reposaient, quelques moments, tout habillés, dans les chambres de la maison de M. Sausse, au murmure menaçant des pas et des voix du peuple inquiet qui chaque minute grossissait sous leurs fenêtres. Tel était l'état des choses à Varennes à sept heures du matin. La reine ne dormit pas. Toutes ses passions, de femme, de mère, de reine, l'indignation, la terreur, le désespoir, se livrèrent un tel assaut dans son âme, que ses cheveux, blonds la veille, furent blancs le lendemain.—*Histoire des Girondins par Lamartine.*

B.—*Second Year Students.*

Translate:—

Il avait erré pendant quarante-deux jours à travers l'Angleterre, successivement caché dans huit asiles différents; quarante-cinq personnes de toute condition, dont les noms sont connus, et sans doute plusieurs autres qu'on ignore, avaient su qui il était et où il était. Pas une ne trahit, même par une indiscrétion, le secret de sa présence ou de ses mouvements. Un dévouement sincère donne aux plus simples de l'habilité et aux plus faibles de la vertu.—*Guizot: Histoire de la République d'Angleterre et de Cromwell.*

PREPARATORY EXERCISES.

A.—Selections for First Year Students.

I. Henri II., roi d'Angleterre, s'égara un jour dans la forêt de Sherwood à la poursuite d'un sanglier. Son cheval l'emporta loin des seigneurs de sa cour, et, à l'approche de la nuit, il se trouva seul dans un endroit de la forêt qu'il ne connaissait pas, et où aucun sentier n'était tracé. Il erra quelque temps à droite, à gauche, sans rencontrer personne. Enfin un meunier et son âne *vinrent à passer* près de là.—'Bonhomme,' lui cria le roi, 'indiquez moi, je vous prie, *le chemin de Nottingham*.'

II. Une ourse avait un petit ours qui *venait de naître*. Il était horriblement laid. On ne reconnaissait en lui aucune figure d'animal : c'était une masse informe et hideuse. L'ourse, tout honteuse d'avoir un tel fils, *va trouver* sa voisine la corneille, qui faisait un grand bruit par son caquet sous un arbre. 'Que ferai-je,' lui dit-elle, 'ma bonne commère, de ce petit monstre? J'ai envie de l'étrangler.'—'*Gardez-vous-en bien*,' dit la causeuse : 'j'ai vu *d'autres ourses* dans le même embarras que vous. Allez : léchez doucement votre fils ; il sera bientôt joli, mignon, et propre à vous faire honneur.'—*Fénélon*.

III. Le lion étant mort, tous les animaux accoururent dans son antre pour consoler la lionne sa veuve, qui faisait retentir de ses cris les montagnes et les forêts. *Après lui avoir fait leurs compliments*, ils commencèrent l'élection d'un roi : la couronne du défunt était au milieu de l'assemblée. Le lionceau était trop jeune et trop faible pour obtenir la royauté sur tant de fiers animaux. 'Laissez-moi croître,' disait-il ; 'je *saurai bien régner et me faire craindre* à mon tour. En attendant, je veux étudier l'histoire des belles actions de mon père, pour égaler un jour sa gloire.'—*Fénélon*.

B. Selections for Second Year Students.

I. Epuisé par les travaux *de la journée*, je n'avais durant la nuit que quelques heures pour délasser mes membres fatigués. *Souvent il m'arrivait*, pendant ce court repos, *d'oublier ma nouvelle fortune;* et, lorsque, aux premières blancheurs de l'aube, les trompettes du camp *venaient à sonner* l'air de Diane, j'étais étonné d'ouvrir les yeux au milieu des bois. Il y avait pourtant un charme à ce réveil du guerrier *échappé aux périls* de la nuit. Je n'ai jamais entendu sans une certaine joie belliqueuse la fanfare du clairon répétée par l'écho des rochers.—*Chateaubriand*.

II. 'Il n'y a personne comme toi pour parler aux enfants,' dit Germain à la petite Marie, 'et *pour leur faire entendre raison*. Il est vrai qu'il n'y a pas longtemps que tu étais toi-même un petit enfant, et *tu te souviens de ce que te disait ta mère*. Je crois bien que *plus on est jeune, mieux on s'entend avec ceux qui le sont. J'ai grand peur qu'une femme de trente ans*, qui ne sait pas encore *ce que c'est que d'être mère, n'apprenne* avec peine à babiller et à raisonner avec des marmots.'—*George Sand*.

III. Voilà le monde pour lequel Alfred de Musset écrivait : c'est dans ce Paris *qu'il faut le lire*. Le lire? Nous le savons tous par cœur. Il est mort, et il nous semble que tous les jours nous l'entendons parler. Une causerie d'artistes qui plaisantent dans un atelier, une belle jeune fille qui se penche au théâtre sur le bord de sa loge, une rue lavée par la pluie, où luisent les pavés noircis, *une fraîche matinée riante* dans les bois de Fontainebleau, *il n'y a rien qui ne nous le rende présent et comme vivant* une seconde fois.—*Taine*.

English-French Exercises.

These exercises are much more difficult, and require far greater knowledge and care than those in French-English translation, and the student will do well to attend to the following recommendations :—

(*a*) Translate as literally as the French idiom will allow.

(*b*) When you write a verb ask yourself what the nominative is, and be sure you make it agree therewith ; similarly, never write an adjective without seeing that you make it accord with the word it qualifies ; in writing a participle, ask yourself what rule applies, and inflect it accordingly.

(*c*) Rather than leave a blank employ a periphrasis.

(*d*) Better leave a blank than insert a gallicised English word at which you make a guess.

(*e*) Be particular about the position in the sentence of pronouns and adverbs.

(*f*) Before beginning to translate any passage, look carefully through it to see if any special idiom or construction is required.

(*g*) Do not resort to the dictionary till you are quite sure you cannot supply unaided the proper word.

Each month we shall give translations of the passages set the preceding month, with explanatory notes where it is thought necessary or advisable.

The passages set last Christmas were—

A.—First Year Students.

Translate into French :—

After ten years of slavery, a lucky chance gave us back our liberty, and we returned to Naples, where we found all our possessions sold, without being able to hear any news of our father. We passed over to Genoa, where my mother went to collect some miserable remnants of an inheritance which they had torn from us ; and thence, flying from the barbarous injustice of her relations, she came to this place, where she has barely been able to exist.

B.—Second Year Students.

Translate into French, either (*a*) or (*b*), but not both of them:—

(*a*) Your audacity is indeed wonderful! Understand, then, to prove you wrong, that at least sixteen years have passed since the man of whom you are speaking perished at sea with wife and children, when carrying out his desire to snatch away their lives from the fierce persecutions that raged during the revolutionary troubles at Naples and caused several noble families to flee thence into exile.

(*b*) True :—but pray understand, on your part, to demolish your argument, that his son, then seven years old, with a servant, was saved from that shipwreck by a Spanish vessel ; and that the son thus saved is he who now addresses you. Let me explain to you, further, that the captain of that ship, touched by my misfortune, conceived a friendship for me ; that he had me brought up as his own son ; and that, as soon as I became capable of so doing, I took up arms as my profession.

PREPARATORY EXERCISES.

A.—First Year Students.

(i.) 'You are right,' coldly replied the fly : 'one is always wrong to approach a nation as fiery as yours.'

(ii.) He was not thinking of what she had told him.

(iii.) If Alexander had not been a great warrior, he would not have subdued the world.

(iv.) I wish to read many German books, that I may be able to speak the German language.

(v.) I have known her since she was ten years old.

(vi.) These children have been six years at school, and it appears that they are making progress.

(vii.) It had just struck two o'clock when the man struck me.

(viii.) I hope it will be fine to-morrow, for we are going to visit the Exhibition.

(ix.) 'What are you thinking of?' 'I am thinking of your brother ; what do you think of his adventure?'

(x.) It is very cold to-day ; my brother and I are cold ; our tea is cold, too.

B.—Second Year Students.

(i.) He was the first to leave the oak table, where he took with his apprentices the daily meals. All rose at this signal and came and arranged themselves in silence by their lathes (*tour*, *m*) ; with the master in their midst, each resumed work with activity.

(ii.) Always tell the truth ; it is a more honest and profitable way to succeed than the cleverest falsehood.

(iii.) 'This vase does not belong to us ; it belongs (*translate each 'belong' by a different word*) to the president, who had sent it with some broth for mother.'

'I am very sorry for it,' replied the potter (*potier*) harshly ; 'that will teach you to take more care of things that don't belong to you ; I can't help it.'

(iv.) Nevertheless, at the end of some days they saw the child reappear, holding in her hand the two sous and a half that she owed the potter ; the latter, surprised and pleased, said to her : 'This is good, my little girl : for you might have dispensed (*se dispenser*) with returning, since I knew neither your name, your address, nor your parent's calling.'

(v.) At this early call Margaret had risen very gently from her pallet (*grabat*, *m*). Darkness still reigned in their dwelling, and yet she found her clothes in the dark as though it had been broad daylight, so great was her order and care. She opened the door noiselessly, and ran with a light step to the spring to bathe her face and hands and to smooth (*lisser*) her thick hair.

(vi.) At this moment something stirred in a dark corner of the garret (*galetas*, *m*) ; a little boy, half dressed, came out, groping (*se glisser à tâtons*) his way towards the stove. She ran to meet him, took his head between her hands and kissed him tenderly. He returned her caresses.

NOTES AND NOTIONS.

BY RICHARD WADDINGTON.

THE Secondary Education Commission is sufficiently representative to be recognised as a strong one. The absence of the Bishop of London and Dr. Dale is to be regretted. As in the selection of the Cross Commission on Elementary Education, the claims of the N.U.T. are recognised by the inclusion of the secretary. And everyone will agree that no better or abler representative could be found. The imperative and immediate duty of the Union now lies in securing full and complete hearing for representatives of the primary schools. It may be taken for granted that the report of the Commission will form the groundwork of legislation on the subject in the near future, and it therefore behoves the primary school teachers to spare no effort in supplying the Commission with the declared conclusions of the twenty-five thousand teachers within the fold of the N.U.T.

* * * * *

COMPLAINT is pretty general as to the difficulty of the tests set in time and tune in certain districts. Ignorance of the real difficulty may in some cases account for the absurdly difficult tests. The following test was set in a Midland district to the fifth and sixth standards :—

d : — : m	r : — : t_1	d : t_1 : l_1	s_1 : — : —
s : — : —	m : — : —	d : r : m	r : — : —
r : — : m	m : — : r	s : — : —	f : m : r
d : — : —	— : — : —		

Note.—Beat twice to the bar, and at M. 90 or over. My correspondent suggests that many Second Year Certificate Students would find their work cut out, especially at the speed indicated.

'I thought of this 'ere milkin' o' the wits,
So much a month, warn't givin' Natur' fits'—

* * * * *

OXFORD and the Oxford Conference just now fill the pedagogic mind. Some hundreds of teachers will hie themselves to

'The land of scholars, and the nurse of arms.'

The ancient seat of learning will during the next few days be the scene of much educational activity. Many of the representatives will enjoy the hospitality of the Colleges. The Examination Hall will ring with the pent-up feelings of England's primary school teachers as point after point is punctuated. Friendships of long ago will be renewed.

'Princes and lords may flourish, or may fade,'

but in Easter week Oxford will be aglow with Codes, the Inspectorate, Superannuation, Drawing, South Kensington, and the sins of omission and commission of 'My Lords' in general and particular.

* * * * *

ON Monday Mr. Gray will give us the President's address. To follow the able men who have preceded him is no easy task, but I have no misgivings as to the successful accomplishment. Tuesday morning will bring the result of the Executive Poll, and the announcement that the next Conference will meet in Manchester. The second session of the Oxford Conference will be somewhat of an innovation. It is to be open to members of the University and others interested in education. Following Mr. A. Sidgwick's paper we may look forward to an interesting discussion, which will do much to clear the atmosphere on the question of Secondary Education.

* * * * *

TUESDAY afternoon is to be devoted to the more domestic side of the Union's policy. The action of the Executive is to be challenged by direct resolution on the allocating to the General Fund a *pro rata* levy from the Legal and Parliamentary Funds. Whatever may be the objections to the new arrangement, there can be no doubt that the former arrangement was unsatisfactory. Generally the Finance Committee allocated a sum at the year end. The sum was a kind of rough guess at the amount due, and too often was altogether inadequate. The result has been that while the invested funds of the Legal and Parliamentary Committees have steadily increased, the General Fund has, year by year, been involved in greater financial difficulties. The result was that the general work of the Union was crippled for want of funds, and at the same time the other two funds were making increased demands on the General Fund. Anyone cognisant with the details of the work of the several departments at Russell Square is fully conscious of the necessity for making the contributions to the General Fund a fixed amount per member.

* * * * *

THE question of the advisability of increasing the entrance fee year by year until it reaches a guinea will not tend to a prolonged discussion. The success of the present entrance fee, and the general agreement as to its inadequacy, will lead to the ready acceptance of an increasing fine for non-membership. The resolution to be moved making the entrance fee double to those teachers who have allowed their membership to lapse, it is to be hoped will meet with unanimous approval. The Union has entered into responsibilities and undertakings that cannot lightly be evaded. The spasmodic member who pays the subscription once every three or four years is a source of danger to the Union. Membership at caprice must be made impossible. The Union has passed the period when non-members were besought in entreating tones to join. The 50 per cent. of the teachers who are outside the Union will want the Union before the Union wants them. A steady application of Union influence to the enrolment of the yearly additions to the ranks of the certificated teachers will soon make non-Unionism impossible.

* * * * *

THE Executive's scheme for the representation of associations at Conference is not likely to be reached in time for full consideration on Tuesday afternoon. On the advisability of altering the present system of voting opinion will be keenly divided. The new scheme would facilitate the registration of the views of the representatives. At present, if a division is claimed the question is generally 'shelved' for that session; and if it be the last, the final vote cannot be taken. Again, under the present system one man may carry one vote and another one hundred votes.

The conversion of a dozen representatives may mean the transference of a couple of thousand or of a couple of dozen votes. This was the more glaring under the old plan of electing the Executive. The fact is, that out of the thousand representatives less than two hundred carry an absolute majority of votes, and it is not always true that voting power is commensurate with difficulties represented. The badly-paid and badly-surrounded teacher too often is least powerful in guiding the decisions of Conference under the present arrangement.

* * * * *

On Wednesday morning, after the University has conferred the degree of M.A. *honoris causa* on the President, Mr. Macnamara is to read his paper on the 'Conditions of Servitude of the Rural Schoolmistress.' That the conditions are bad no one is more convinced than the able Editor of the *Schoolmaster*, and no member of Conference will be more anxious to find means of improvement. Aptly the question next on the agenda is 'Rate-Aid to Denominational Schools.' I have already explained the necessary conditions that must accompany Rate-Aid in the interest of education, and I look to an interesting discussion on the subject.

* * * * *

Wednesday afternoon will be devoted to the charities of the N.U.T. The purses are to be received by H.R.H. Princess Christian, and the Sheldonian Theatre will be the scene of great and enthusiastic effort in behalf of the poor and needy amongst us.

> 'Taught by that Power that pities me,
> I learn to pity them.'

And the busy workers in the cause of the Orphan and Benevolent Funds of the Union will bring well-laden purses to present to Her Royal Highness as willing and generous tribute to ease the lot of some less fortunate brother or sister. The sum total may not exceed that of Liverpool, although I sincerely trust it will, but the same crowd of loving workers will assemble as of yore.

* * * * *

Thursday morning is to open with the hardy annual, 'Age and Attendance.' Despite the very large majority which confirmed the resolution of the previous three conferences at Liverpool last year, war is to be waged once more against the 'Age and Attendance Scheme.' Until some misfortune gives the 'Age only' advocates a chance majority, which will destroy continuity of action in the future on questions of policy where the opposition is fairly strong, we may anticipate the annual discussion of this subject. What the representatives have to face is a 'Leaving Certificate' or an 'Attendance Certificate.' 'Age only' is not within the range of practical politics. Educationists are too well acquainted with the inefficiency of the local authorities in enforcing school attendance to take away entirely the second qualification. The Leicester Association goes for the abolition of 'half-time' by fixing the age at 13. A wider acquaintance with the manufacturing and rural districts would demonstrate the foolhardiness of cutting away the second qualification until the age is fixed at 13. Even Mr. Acland, heart and soul as he is in favour of raising the age, dare not go beyond 11 in his School Exemption Act of last year. The matter is one of serious moment. By reversing the policy of the Union the Executive's efforts to carry out the wishes of the last four conferences will be frustrated, and, still worse, educationists will be extremely cautious in assisting the furtherance of the decrees of Conference.

* * * * *

Following 'Age and Attendance' comes the consideration of the Special Report of the Executive on Salaries of Teachers, and a Sustentation Fund. This resolution might well have been taken with the Rate-Aid debate. It is closely involved in the question. I hope the Conference will exhibit greater courage on this question than did the local associations. Call it by what name you like—Trades Unionism or anything else you will—something must be done for the poorly-paid members of our Union, and that soon.

* * * * *

The last Session is mainly devoted to the very interesting ceremony of awarding thanks, although there is a resolution from Manchester suggesting that the country should be at once divided into four districts, and the appointment of an adequately paid secretary for each division, that is of more than passing importance. Anyone acquainted with the work demanded by the present arrangement must feel the imperative need for decentralisation. I am not quite sure that four districts ought to be the first step. I would prefer to ask for two. Day by day the Union is face to face with the necessity for the local intervention of an able and fearless official who could state the teacher's case without fear of consequences. Admirable as may be the Board School system in the large towns, it is thoughtlessly and needlessly tyrannical in many cases. The presence of an able official of the Union would do much to prevent this falling unduly on the teachers. Come we shall, sooner or later, to some similar arrangement, if not to this identically, and you know the truism—'What Manchester thinks to-day England thinks to-morrow.'

* * * * *

The Supplementary Agenda is as full as usual. I have often thought the questions relegated to the Supplementary Agenda so interwoven with the practical, every-day, bread-and-butter life of the teachers as to tempt one to move that the last truly and really come first by reversing the order of the agenda.

* * * * *

It is very often forgotten that in many of our inland towns, notwithstanding the facilities for reaching the sea-coast, there are adults, not to mention school-children, who have never seen the sea. I read the following story in a local paper:—

'An old man who had never seen the sea went by excursion to Blackpool, and was accompanied by his wife, almost as old, and three sons. The five stood in a row on the beach and gazed at the rolling deep for fully five minutes before a word was spoken. Then the old man turned to his wife and said, "Well, Sarah, what do you think of it?" "I believe it's bigger'n our old farm," she replied. "Bigger! I should think it is! Hain't she purty? I've allus heard and read of the ocean, and here she is at last. It's a sight worth seein'—eh, boys?" "Yes, father," answered one; "but I don't see a whale or a shark." "No, nor do I either; but don't be in a hurry, Henry. Give her time. She's a big body of water, and has got to move slow. There's sharks and whales in there as sure as you are alive, but give 'em time—let 'em have a rope. We've got four hours to stay, and won't jump on her for a swindle until we've given her a fair trial."'

Southampton would appear to be likely to be a repetition of Brighton in the matter of the dismissal of the teachers. The local Trades Unionists in Southampton seem determined to see fair play given to Miss Goodwin. Never was there a clearer case of a teacher being dismissed because she refused to allow her reputation to be ruined without appeal. Her chief offence has been that she appealed to her Union when the School Board refused to assist her. One would have thought that the Brighton lesson would have been more effective. In this Southampton case Mr. Clancy has worked hard. His eloquence and courage have done much to sustain the teachers in trying circumstances, and his sound common sense has kept the Union clear of rocks ahead.

TEACHERS' DRAWING LESSONS.

FREEHAND.

Standard V.

BY E. BUFFERY RIDGE,
Art Master under the London School Board.

Fig 4. *A chrysanthemum leaf*, drawn from nature. The edges of this leaf are sharply cut; in some

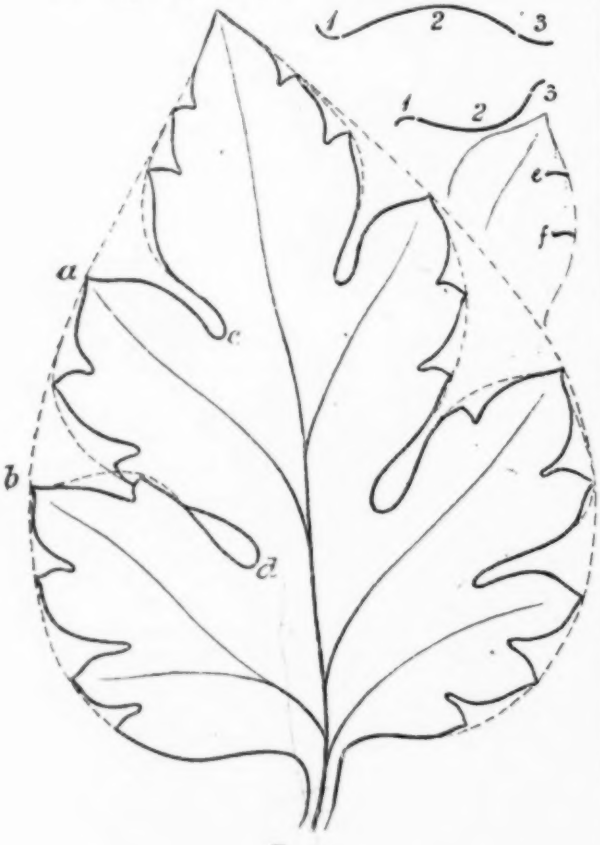


Fig. 4.

varieties the corners are much more rounded, resembling those of the oak leaf in Standard IV.

To preserve the *character* of the leaf in the drawing, great attention must be given to the *shape* of the curves. Each is composed of three parts—a long curve in the middle, and a short one at each end, as is shown at 1, 2, 3. Moreover, there is a difference between the two edges of each leaflet, the middle curve (2) being flatter in one—generally the upper—edge than in the other. This will be found to be true of the whole leaf, as well as of each part of it. The *growth* of the leaf, which should next be studied, depends on the *position* of the curves. Every line is so placed that by continuing the curve it might be shown to flow into the main stalk, either directly or through one of the principal veins.

The length and width of the copy having been compared, and marked on the drawing-paper, settle next the position of the apex a little to the left of what would be a centre line. Draw the two outer curves enclosing the leaf, and mark points *a*, *b*, &c., comparing the distances between the points in order to space out the drawing correctly. Put in the central vein and the other veins, then mark points *c*, *d*, &c., for the deep notches, or eyes.

Draw the curve from *a* to *c*, which has no serrations, and any similar curves, then the remaining curves of the principal lobes, as shown by dotted lines in the copy.

Look at the small sketch of a lobe—the right-hand curve is to have two notches. First space them out on the enclosing curve, then draw the *short* curves, as at *e* and *f*, noting length required and direction, so as to flow towards the base of the leaf. It will then be very easy to add the remaining curves.

In lining in, try to get thin lines for the veins, slightly tapering towards the stalk; but remember that the outline requires freely-flowing curved lines, all one thickness, and without breaks, and that a line of moderate thickness will look better than a very fine one.

After drawing this leaf the children should be encouraged to bring chrysanthemum leaves (season permitting), and draw from them instead of from a copy. It will be interesting to note how much variety may be found without departure from general character.

Fig. 5. *Anthemion, or honeysuckle ornament.* Something like the honeysuckle blossom, but it is not at all likely that the Greek artists who drew it thousands of years ago copied it from the flower. They did not draw flowers, but the most beautiful forms they could design, and this is one of them.

There are hundreds of varieties of this ornament, all consisting of curved leaflets arranged symmetrically and in perfect harmony; some, like this copy, curved inwards, some outwards, but all alike true to the principle of growth or radiation, each line upspringing from the central stalk or root.

In drawing the dotted lines note how they are derived from the ornament, the outer curves touching the backs of the hooked leaflets, the inner curves passing through their points, thus giving the cross lines, which divide the centre line into four nearly equal parts. Look at the little fan-shaped figure at the bottom, from which all the lines spring. Draw it, and mark seven points on each side along the top of it, taking care to avoid the common mistake of getting the middle pair of marks too wide apart.

Now sketch the centre leaf, with particular attention to the width at each cross line.

Mark the points at which the 'hooks' touch the outer curve, and compare the size and shape of the three hooks on the left-hand side. They decrease in size from top to bottom. Each has an outer curve and an inner curve. Both outer and inner curves decrease proportionately; so also does the width of the leaflets between the curves. The curves, being continued, run downwards to the centre point at the bottom of the copy. Draw all of them, as shown by dotted lines in two instances. The outer curves should be drawn first on the right-hand side, then on the left, then the inner curves.

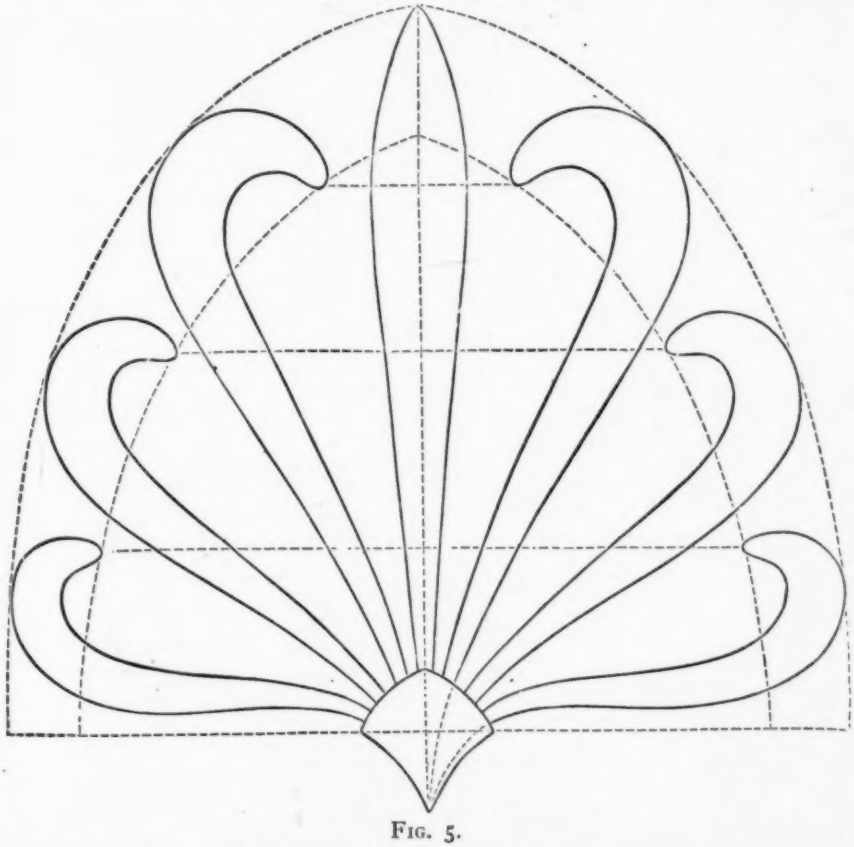


FIG. 5.

The long lines radiating from the bottom are the hardest part of this figure. None of them are quite straight, but the centre pair are nearly so; then they curve slightly more and more downwards, the lowest and smallest pair of leaflets bending the most.

Turn the drawing-paper about in lining in, so as to bring each curve into a good position, *i.e.*, with the hollow side towards the pencil.

☛ See the 'GIRLS' MISTRESS' for a Juxtalinear Translation of MOLIÈRE'S LE MISANTHROPE, with Copious Notes, Examination Questions, &c., by Professor DARQUÉ.

HONOURS PHYSIOGRAPHY NOTES.

BY R. A. GREGORY, F.R.A.S.,

Oxford University Extension Lecturer, Honours Medallist in Physiography, Author of 'Elementary Physiography,' &c.;

AND

H. G. WELLS, B.SC. (LOND.),

Lecturer in Geology at the University Tutorial College, Fellow (in Honours) and Doreck Scholar of the College of Preceptors.

RAINFALL RECORDS IN THE BRITISH ISLES.

At a lecture recently delivered at the Society of Arts, Mr. G. J. Symons, F.R.S., gave an interesting account of rainfall records in the British Isles. In the course of the lecture a number of important matters connected with rainfall observations were brought out. One of these relates to the best pattern of rain-gauge. In the first place, there is the question of size, whether a gauge should be one inch or two inches, or eight inches or two feet, or even more in diameter. Mr. Symons, and the numerous observers who observe in co-operation with him, have tried rain-gauges of nearly all diameters from one inch up to six feet square, and the practical result is that they do not differ as much as five per cent. in any case, and differ to that extent only in extreme cases, like the six-feet gauge, where the indications are disturbed by the excessive condensation of dew; with the exception of that, they all agree within less than one per cent. Therefore it is simply a question which is the most convenient size, and which is the most comfortable for manipulation; and, to a slight extent, which is the least expensive. Of all the gauges at work at the present time, something like eighty per cent. are five inches in diameter, and the other twenty per cent. are mostly eight inches in diameter.

What is known as the Snowdon gauge is a very good form to use. On the top of the receiving funnel a hollow cylinder some six inches high is placed, and its object is to collect any moderate fall of snow. If a gauge without such a protecting cylinder is used, the snow is frequently blown out of the funnel, and an inadequate measure of the fall is obtained. Within this rim, or at any rate up to five or six inches of it, the snow can be readily collected. The measurement, when of rain, is made by pouring into a measuring glass the water from the bottle into which the funnel leads, and reading off its depth. In cases of snow, the quantity collected by the gauge must be melted, and then measured by means of the measuring-glass.

Passing to gauges designed to record automatically, Mr. Symons described the Beckley and Cassella patterns, the former being the one adopted by the Meteorological Council. This consists essentially of a cup floating in a basin of mercury. When, owing to the fall of rain, the cup increases in weight, it becomes more and more immersed. A fall of $\frac{2}{10}$ths of an inch of rain fills the vessel up to the level of a syphon, which then comes into operation, discharges the water, and the vessel, being empty, rises to the original level. As the vessel increases in weight it carries a pencil down with it, and when emptied, the pencil returns to the zero. The pencil presses against a cylinder turned by a clock, so a record is obtained of the intensity and the time at which the rain fell. In Cassella's recording gauge a brass weight is counterpoised by a small bucket, into

which the rain is led. As the weight of water in the bucket increases, the balance is disturbed, and the bucket moves to a greater and greater distance from its position of rest. When the bucket has descended to a certain position, it reaches a small projection. The instant this point is reached the bucket capsizes, the water is discharged, the bucket goes back to its original place, and the pencil goes back to zero to begin again.

As regards the proper elevation of a rain-gauge, Mr. Symons remarked that the first observations as to whether more rain fell on a roof or on the ground were made more than one hundred years ago on the top of Westminster Abbey by the late Dr. Heberden. He had three gauges—one on the roof of the dwarf tower of Westminster Abbey, one on the roof of a house close by, and another in the garden of the same house. The results for the year 1766 were that in the garden he collected twenty-three inches, on the roof of the house eighteen inches, and on the top of the tower twelve inches. Similar results have been obtained since then, and it has been shown that the decrease with elevation is not uniform, a very large proportion of it occurring in the first fifteen or twenty feet above the ground. Most of this decrease appears to be due to the velocity of the wind passing over the rain-gauge. The friction of the air against the ground causes it to move with much less velocity there than it does over an exposed position, like the top of the centre tower of Westminster Abbey.

The wettest station in the British Isles, as most people know, is a place some miles to the south of Keswick, at the head of Borrowdale, called Seathwaite. The rainfall there on the average of a long series of years is about 140 inches a year, or nearly six times as great as it is in London. The wettest place in Scotland appears to be Sligachan in Skye. Though Ireland has a reputation for being very wet, in no part of it is the rainfall nearly equal to that of the English lakes and along the west coast of Scotland.

It is worth remark that the heaviest single rainfall ever measured by Mr. Symons occurred on June 23,1878. It is an unusual thing in London for an inch of rain, that is 101 tons weight per acre, to fall in twenty-four hours, but in this case there was a fall of 3¼ in. in an hour and a half.

Origin of the Crystalline Schists.

The question of the origin of gneisses has already occupied a considerable amount of our attention. We may perhaps take the opportunity afforded by the belated publication of a short paper by Professor Bonney in the *Geological Magazine* to summarise these views.

(i.) There is first the view of the elementary text-book, now becoming at least old-fashioned, that most, if not all, gneisses *are the final results of the heat and pressure metamorphism of sedimentary rocks.*

(ii.) This was modified by the consideration that granitic rocks under pressure and heat might also become foliated. The phases in such a course of change begin with the development of 'augen.' (Compare our note in the February issue on Mr. Goodchild's paper.) In this new modern view all gneisses are regarded as the final results of the heat and pressure metamorphism of sedimentary or *igneous* rocks.

(iii.) Professor Bonney, however, bases upon a most detailed and elaborate study of the structure of gneisses, the view that the foliated structure could be produced in *molten* rock by a movement of the constituents when the mass was not perfectly consolidated. 'But,' says he, 'I have never been able to find any proof of the notion that a broad banding can be produced by any amount of crushing in an ordinary holo-crystalline rock, while I have demonstrated, as I venture to think, that it can come from movements anterior to the consolidation of the mass; so that while we may admit the possibility of the former explanation being true for a certain group of rocks in which the bands of mica or of other minerals are thin, we must deny it in all cases where they are even moderately thick.' He thinks that sedimentary rocks may frequently be changed into calc quartz and mica schists, but that they rarely give rise to gneiss. It would, however, he considers, be rash *at present* to assert that a sedimentary rock can never become a gneiss. The common gneiss is a gneiss *in consequence of an original structure;* is, in fact, he asserts, not a metamorphic rock at all. Another type of gneiss is the result of pressure and heat acting upon an already solidified crystalline igneous rock. A third and rare type, if it occurs at all, is due to the metamorphism of sediments. It is evident that the views of geologists on this question have passed through an almost complete revolution.

Professor Bonney would probably have modified his paper to a certain extent had he been aware at the time of writing of Mr. Goodchild's work, but through some editorial confusion the latter paper, though written after Professor Bonney's, was printed in the *Magazine* before it.

The Geographical Distribution of Cyclones.

The student is already familiar with the principal theories held concerning the origin of cyclones and anti-cyclones. (*Honours Physiography*, p. 89, sqq.) To this we would add the following facts concerning their geographical distribution:—Cyclonic storms have never been known to originate within 5° of the equator, but through the belt of the tropics lying next to this region the most violent and fitful hurricanes occur. This is especially the case near the West Indies and in the Indian and China Seas. The West Indian cyclones generally arise between 10° and 20° N. lat., and move westwards at an average speed of 15 miles per hour till they reach the thirteenth parallel, when they curve round by north to east. Those of the Indian Ocean and China Sea generally take a westerly course at first, sometimes curving round eastwards, but all storms in this region vary very greatly in their nature and mode of progress with the seasons of the year. Their average speed is slower than those of the West Indies.

The general plans of the routes most frequently taken by cyclones is given by the map in 'Elementary Physiography' (p. 322.) It has been shown that in Western Europe most cyclones move in an easterly direction, westward motions being generally slow and of short duration. It has also been found that cyclones tend to move along definite routes according to the seasons of the year. These results have been established by Ley, who has also investigated the paths they travel along. The following are the five principal routes as they are given in Dickson's Meteorology, from the results of a discussion instigated by Van Bebber:—

(I.) Beginning at the north-west of the Outer Hebrides, the first route runs in a north-easterly direction along the coast of Norway till it cuts the Arctic Circle, where it divides. This route is followed by cyclones all through the year, and more especially in autumn and winter.

(II.) The second route commences at the north of the Shetland Isles and runs to the Gulf of Finland. Storms following this track are not of frequent occurrence.

(III.) The third starts further north than the second, and proceeds to the Skagerak or to central Sweden, then on arriving at the Baltic cyclones take either an easterly or south-easterly course. They almost always occur between September and March.

(IV.) The fourth runs from the mouth of the English Channel to the Gulf of Finland, and is a course which is followed chiefly during summer by shallow depressions. Some severe winter storms have been known to travel through this route; as an example of this we may cite the great blizzard of March 9th and 10th, 1891.

(V.) The last route also has its origin at the mouth of the English Channel, and passes in a south-easterly direction parallel to Route III. to the Gulf of Genoa; here it divides into three; one branch turns northward through Switzerland to the shores of the Baltic in Russia, the second eastwards to the Black Sea, while the third makes a curve southwards into the Mediterranean. This route is taken most frequently during the winter.

It must be borne in mind that this is necessarily a generalization, as these five principal routes vary slightly from month to month, and also the prediction of weather is complicated by the fact that that there are a large number of depressions which do not follow any of them exactly.

Van Bebber has also given the results of his observations on the rate of advance of these depressions. Their velocity varies between wide limits, and he gives as an average of 1,678 cases, a mean velocity of 16¾ miles per hour, the highest average of 19½ miles being in October, and the lowest of 14½ miles in August. He reports, too, that depressions travelling along the principal routes move as a rule with a much greater velocity than those which follow no consistent path, and that Routes I., II., III. and V. are generally remarkable for the highest averages.

There is a difference between the rate of movement of deep depressions and shallow ones, the deep moving on the whole faster than the shallower. But a marked increase of velocity is noticeable in cyclones which are increasing in depth and violence, and conversely an increase of velocity occasions an increase of depth. Further, a cyclone keeping a regular depth moves more slowly than one which is becoming shallower.

The General Dynamics of the Air.

A series of articles on this subject by Professor M. Möller have been appearing in the *Meteorologische Zeitschrift*, treating of some of the most important processes at work in the air. He discusses the atmospheric phenomena in which aqueous vapour has a share, and brings up argument to disprove the usual theory that ascending air currents are greatly aided in their upward motion by the heat set free by condensation during cloud formation. The usual example is to compare two columns of air, having the same

temperature at their base but whose temperature falls with increasing height at a rate different in the two tubes, as one is supposed to be composed of dry air, very cold at the summit, and the other moist air, warmed by the effect of condensation. Professor Möller, however, does not consider that this difference arises in this manner. He points out that to produce a circulation in two vertical tubes communicating at both ends, it is necessary to heat the air at the base of one and cool the top part of the other. A source of heat placed at the top would simply produce equilibrium. Similarly the upper strata of air are warmed by condensation of the aqueous vapour, and a condition of stable equilibrium is produced. This warming cannot aid an ascending current of air or give rise to depressions. Professor Möller therefore attributes the origin of cyclones to horizontal, and not to vertical, differences of temperature. We shall return to a fuller discussion of the general theory of atmospheric circulation next month.

Professor Langley's Bolometric Researches.

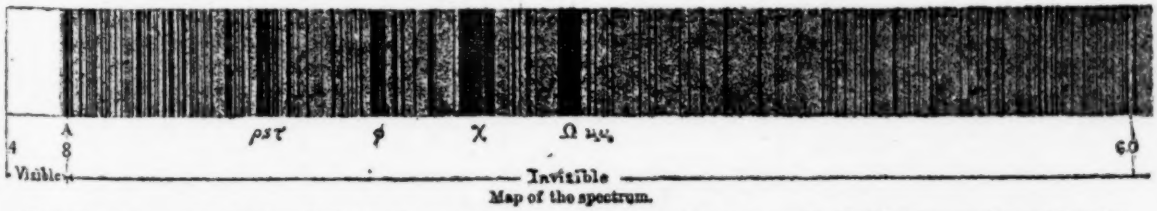
That the solar spectrum does not cease at the limit of visibility has long been known. The photographic plate shows that rays (ultra-violet rays) capable of chemical action exist far beyond the deepest violet of the solar spectrum, and a similar region, consisting of infra-red rays, exists below the visible red end of the spectrum. Professor S. P. Langley stands first among the distinguished physicists who have directed their attention to the investigation of the infra-red part, the light of which is manifest neither to the eye nor to any ordinary process of photography, but which nevertheless comprises more than three-fourths of the energy which the sun sends to us. A report of the work he has recently been carrying on in the Astro-Physical Observatory of the Smithsonian Institution in the United States has just been published, and we give here the chief points contained in it.

It is impossible to employ ordinary methods of spectroscopic investigation for the infra-red region to which reference has been made. Some years ago Professor Langley devised a method which has in the course of the last two years been perfected to such a degree as to enable the lines in this invisible spectrum to be found and mapped with a degree of accuracy only inferior to that which can be attained by the eye.

The instrument by which this is accomplished is the bolometer, which, as now constructed, is a minute strip of metal barely $\frac{1}{500}$ of an inch wide, and less than $\frac{1}{5000}$ of an inch thick. Through this frail thread of metal a current of electricity is continually kept flowing. When the spectrum, visible or invisible, is thrown upon it, the thread is warmed and the current decreased by an amount corresponding to the intensity of the effect received, while novel instruments specially mounted and constructed, are in electric connection with the thread, and now automatically record every minute change in this current.

With late improvements these instruments are so delicate that a change of temperature of one millionth of a degree is readily detected and even measured, and it is easy to see that as a consequence of this delicacy the greatest care must be taken in their use.

The accompanying illustration of the invisible spectrum obtained by Professor Langley by means of this instrument gives a general idea of the novelty, the extent, and the value of this field of labour.



Map of the spectrum.

The visible solar spectrum first investigated by Sir Isaac Newton is represented as to its length by the blank space on the left, the numbers ·4 and ·8 representing the extremities of the solar spectrum as known to him. Below this all is invisible, and the investigations made by Professor Langley with his bolometer have been chiefly instrumental in carrying the mapping of lines through nearly thirteen times the extent known to Newton.

Were the range of the human eye vastly extended, so as to enable us to receive impressions corresponding in character to the kind of energy which is present in this infra-red region, we should see in it phenomena of precisely the same character as we now see in the limited spectral region to which we are physiologically limited. It was probably this idea which led Melloni to the use of the term 'heat colour' to convey to the mind some idea of this similarity between the invisible and the ordinary visible spectrum, and this term expresses by the force of association the characteristics distinguishing one portion of this region from another, characteristics which, although unrecognised by the eye or by any of our senses directly, are yet more striking in their various physical results than the various colours which mark out to the eye the great divisions of the visible spectrum.

This invisible portion, then, is marked by narrow bands or lines, which are almost entirely devoid of energy, quite like those which appear in the visible spectrum as black lines, and are known as the 'Fraunhofer lines.' It is to the study of these Fraunhofer lines of the visible spectrum, that we owe nearly all those recent advances which have not only given us definite information as regards the constitution and nature of the heavenly bodies, but have been of immense advantages in the study of meteorological and atmospheric phenomena on the earth. The practical importance of the study of the character of these lines in the invisible spectrum (where their intensity and probably their number is far greater than in the visible) is evident. Much has been gained by the application of photography to spectroscopy, and still more may be expected from the development of our knowledge of the red or less refrangible end of the spectrum in the way opened by Professor Langley.

OUR 1894 CERTIFICATE CLASS.

BY DR. GEORGE BEACH, M.A.,

Co-Author of 'A Manual of our Mother Tongue,' 'A Girls' Arithmetic,' Author of 'Elements of English,' 'Entertaining Readers,' 'Historical Readers,' etc.

1. Science and Art Information.

(*a*) Calendar of Examinations.

If on the 25th of April, Science Examination Forms have not been received, or if wrong numbers have been sent, the Science and Art Department must be informed *at once*.

28th April, 6 to 10 p.m.—I. Practical Plane and Solid Geometry.

30th April, 7 to 10 p.m.—VIA. Theoretical Mechanics, Solids.
Principles of Ornament, Subject 22, Elementary and Advanced.

1st May, 7 to 8 p.m.—Model Drawing, Subject 3*a*, Elementary.
8.30 to 10 p.m.—Freehand Drawing of Ornament, Subject 2*b*, Elementary.

2nd May, 7 to 10 p.m.—Drawing in Light and Shade, Subject 5*b*, Elementary.
Anatomy, Subject 9.

3rd May, 7 to 10 p.m.—VII. Applied Mechanics.
XVI. Zoology.
Perspective, Subjects 1*c* and 1*e*, Elementary and Advanced.

4th May, 7 to 10 p.m.—VIB. Theoretical Mechanics, Fluids.
Freehand Drawing of Ornament, Subject 3*b*, Advanced.

5th May, 6 to 10 p.m.—II. Machine Construction and Drawing.
III. Building Construction.
IV. Naval Architecture.
Drawing in Light and Shade, Subject 5*b*, Advanced.

7th May, 7 to 10 p.m.—XXIII. Physiography.
7 to 9.30 p.m.—Model Drawing, Subject 5*a*, Advanced.

8th May, 7 to 10 p.m.—XVIII. Principles of Mining.
V. Mathematics, Stages 6 and 7.
XXIV. Principles of Agriculture.
6 to 10 p.m.—Design, Subjects 23*c* and 23*d*, Elementary, Advanced, Honours.

9th May, 7 to 10.30 p.m.—Mathematics, Stages 1, 2, and 3.
6 to 10 p.m.—Drawing from the Antique, Subject 8*b*².

10th May, 7 to 10 p.m.—IX. Magnetism and Electricity, including Alternative Elementary Physics.*
6 to 10 p.m.—Drawing from the Life, Subject 8c².
11th May, 7 to 10 p.m.—VIII. Sound, Light, and Heat, Elementary.†
VIIIA. Sound, Advanced and Honours.
10 a.m. to 4 p.m.—Painting from Still Life, Subject 15.‡
21st May, 7 to 10 p.m.—X. Inorganic Chemistry, including alternative Elementary Chemistry.§
22nd May, 7 to 10 p.m.—XIV. Human Physiology.
23rd May, 7 to 10 p.m.—V. Mathematics, Stages 4 and 5.
XXV. Hygiene.‖
21st to 23rd May, 4 to 10 p.m.—Architectural Design, Subject 23*b*.‡
24th May, 7 to 10 p.m.—XX. Navigation.
XII. Geology.
25th May, 7 to 10 p.m.—XI. Organic Chemistry.
XXII. Steam.
26th May, 6 to 9.30 p.m.—X*p*. Practical Inorganic Chemistry, Elementary.
28th May, 7 to 10 p.m.—VIIIB. Light, Advanced and Honours.
29th May, 7 to 10 p.m.—XV. General Biology.
XIX. Metallurgy.
30th May, 7 to 10 p.m.—VIIIc. Heat, Advanced and Honours.
31st May, 7 to 10 p.m.—XVII. Botany.
6 to 7 p.m.—Drawing the Antique from Memory, Subject 8*f*.
1st June, 7 to 10 p.m.—XIII. Mineralogy.
XXI. Nautical Astronomy.
Historic Ornament, Subject 22*d*.
6 to 10 p.m.—Architecture, Subject 1*d*.
2nd June, 2.30 to 10.30 p.m.—X*p*. Practical Inorganic Chemistry, Honours.
6 to 10.30 p.m.—X*p*. Practical Inorganic Chemistry, Advanced.
4th June, 6 to 9.30 p.m.—XI*p*. Practical Organic Chemistry, Elementary.
6 to 10.30 p.m.—XI*p*. Practical Organic Chemistry, Advanced.
2.30 to 10.30 p.m.—XI*p*. Practical Organic Chemistry, Honours.
5th June, 7 to 10 p.m.—XIX*p*. Practical Metallurgy, Elementary.
6th June, 6 to 10 p.m.—XIX*p*. Practical Metallurgy, Advanced.
2 to 10 p.m.—XIX*p*. Practical Metallurgy, Honours.

(*N.B.*—Scholarship Candidates, Pupil Teachers, and others should also note the above.)

(*b*) REQUIREMENTS FOR THE 'D' CERTIFICATE.

Subject.	First Class.	Second Class.
Freehand	(1) Any second-grade certificate for freehand obtained before July '88; *or* (2) A first-class since July '88	Any second-grade certificate for freehand.
Model	(1) Any second-grade certificate for model on paper obtained before July '88; *or* (2) A first-class since July '88; *or* (3) A pass in model on blackboard since '93	Any second-grade certificate for model on paper or blackboard

* A paper will be set in Elementary Physics at the examination on 10th May, and a Candidate may on that date take either it or the paper in the ordinary elementary syllabus of Subject IX.; but no Candidate may be examined in the syllabus of the ordinary elementary stage of Subject IX., or of Subject VIII. on the 11th May, and also in this alternative syllabus.

† Candidates in the first stage must take it as a whole, and will be expected to answer questions in Sound, in Light, and in Heat. In the second stage and in the examination for Honours, the subject will be taken in three sub-divisions, and a candidate will be allowed to take up one or more of the sub-divisions, viz., Sound, Light, or Heat, in the same or in different years. But no candidate may offer himself for the Honours examination in any sub-division unless he has passed the second or advanced stage in that sub-division.

‡ On the 11th, 21st, 22nd, and 23rd May, the six hours include half an hour for refreshment. On 11th May the half-hour must be taken by all Candidates from 1 p.m. to 1.30 p.m. On the other dates the half-hour each evening must be taken by all Candidates from 7 p.m. to 7.30 p.m.

§ A paper will be set in the First Stage of Inorganic Chemistry, and also in the alternative First Stage, and a Candidate may take *either* paper, but not *both*.

‖ No Candidate can obtain Honours in Subject XXV., unless he has previously passed in its advanced stage, and in the advanced stage of Subject XIV.

Requirements for the 'D' Certificate—*cont.*

Geometry	A pass in the elementary stage of Science Subject I.; *or* Either a pass in second-grade geometry or a pass in Section I. of Science, Subject I., together with any certificate for second-grade perspective secured before July '88, or a first-class between July '88 and Jan. '93, or a pass since Jan. '93.
Shading from Casts	Any second-grade certificate for Light and Shade obtained before '93; *or* A first-class taken since '92.

Candidates for the 'D' may be required to be examined in any subject in which they have passed more than three years previously.

The above table has been inserted (now for the third time) to meet the demands of various readers, whom we must kindly request to preserve it, in order to obviate unnecessary correspondence.

II. POST OFFICE SAVINGS BANK.

Alterations in the annual limit of ordinary deposits, and in the annual and total limits of Stock Investments.

By the Savings Bank Act, 1893, the amount which may be deposited in any Savings Bank account in any one year has been raised to £50.

The limits of Stock Investments have also been increased, and investments may now be made to the extent of £200 in any one year and £500 in all.

(N.B.—*Women Scholarship Candidates should also note the above.*)

III. MATHEMATICAL SOLUTIONS.

(*a*) A tradesman bought some goods and sold them again so as to gain 4 per cent. If he had bought them at 4 per cent. less and sold them for £4 15s. less, he would have gained 2 per cent. Find original cost price.

$\frac{104}{100}$ of cost price = first selling price;

$\frac{96}{100}$ of first cost price = second cost price;

$\therefore \frac{102}{100} \times \frac{96}{100}$ of first cost price = second selling price;

But $\frac{104}{100}$ of first cost price — £4 15s. = second selling price;

$\therefore \left(\frac{104}{100} - \frac{102 \times 96}{100 \times 100}\right)$ of first cost price = £4 15s. 0d.

$\therefore \frac{38}{625}$ . . . . . = £4 15s. 0d.

$\therefore \frac{1}{625}$ . . . . . = 2s. 6d.

$\therefore$ first cost price = £78 2s. 6d.

(*b*) A hundred gallons of liquid contains 70 per cent. of wine and 30 per cent. of water. How much wine should be added to the mixture to raise the proportion of wine to 80 per cent.?

The quantity of water is fixed; when it is 30 per cent., the number of gallons is 100. What must be number of gallons when the water is only 20 per cent. of the mixture?

	p.c.		p.c.		galls.		galls.
As	20	:	30	::	100	:	150

$\therefore$ 50 gallons of wine must be added.

(*c*) A's present age is to B's as 9 : 5. 23 years ago the proportion was 10 : 3. Find the present age of each.

(The method of this solution *must* be akin to algebra.)

B's present age = $\frac{5}{9}$ of A's present age.

23 years ago { B's age = B's present age — 23 years.
A's age = A's present age — 23 years.

But from question, 10 (B's present age — 23 years) = 3 (A's present age — 23 years).

But B's present age = $\frac{5}{9}$ A's present age.

$\therefore$ 10 ($\frac{5}{9}$ A's present age — 23 years) = 3 (A's present age — 23 years).

$\therefore \frac{25}{9}$ A's present age — 230 years = 3 times A's present age — 69 years.

$\therefore \frac{8}{9}$ A's present age = 161 years.

$\therefore$ A's present age = 63 years.

$\therefore$ B's present age = $\frac{5}{9} \times 63$ years.
= 35 years.

(*d*) If a 30-gun frigate firing each gun 4 times in 5 minutes uses in 3 hours 61 tns. 14 cwts. 1 qr. 4 lbs. of metal, how often must an 81-gun ship fire its guns to use up 781 tns. 1 cwt. 1 qr. 20 lbs. in 5 hours, the ship's balls being 3 times as heavy as the frigate's?

A Compound Proportion Sum.

N.B.—4 times in 5 minutes = $\frac{4}{5}$ per minute.

Tns. 781-1-1-20 = 1,749,600 lbs.; tns. 61-14-1-4 = 138,240.

	guns		guns		times per min.	
As	81	:	30	::	$\frac{4}{5}$	: x.
	hrs.		hrs.			
	5	:	3			
	lbs.		lbs.			
	138,240	:	1,749,600			
	heaviness		heaviness			
	3	:	1			

$$\therefore \frac{4 \times 1 \times 1{,}749{,}600 \times 3 \times 30}{5 \times 3 \times 138{,}240 \times 5 \times 81} = x.$$

$\frac{2}{3}$ times per min. = x.

Or 3 shots in 4 minutes.

(*e*) A traveller sets out for a certain place, and travels one mile the first day, two the second, and so on. In 5 days afterwards another one sets out, and travels 12 miles a day. How long and how far must he travel to overtake the first?

Let x = the number of days.

Then $x + 5$ = the number the first travels,

$\therefore \frac{(x+6)(x+5)}{2}$ = the distance travelled in miles,

and $12x$ = the distance the second travels,

$\therefore \frac{(x+6)(x+5)}{2} = 12x$, etc.,

$\therefore x = 3$ or 10,

and the distance is either 36 or 120 miles.

(*f*) A and B, 165 miles apart, set out to meet. A travels a mile the first day, 2 miles the second, 3 miles the third, etc. B travels 20 miles the first day, 18 miles the second, 16 miles the third, etc. How soon will they meet?

Let x = the number of days required,

then $1 + 2 + 3 \ldots\ldots\ldots\ldots + x = \frac{(1+x)x}{2}$

= number of miles A travelled,

and $20 + 18 \ldots + 20 - 2x + 2 = \frac{(42-2x)x}{2}$

= number of miles B travelled,

$\therefore \frac{(43-x)x}{2} = 165.$

$\therefore x^2 - 43x = -330$, etc.,

$\therefore x =$ 10 or 33.

The answer may be thus explained. They meet in 10 days. On the 10th day B travels 2 miles, and the next day he rests. The following day he returns 2 miles, the succeeding day 4, and so on. On the 33rd day he again comes up with A.

(*g*) There are four numbers in arithmetic progression. Their continual product is 1680, and common difference is 4. What are the four numbers?

Let $x + 6$, $x + 2$, $x - 2$, $x - 6$ be the numbers.

Then $(x^2 - 36)(x^2 - 4) = 1680$,

$\therefore x^4 - 40x^2 + 144 = 1680$,

$\therefore x^2 = 64$, or -24.

(-24 is impossible.)

$\therefore x = \pm 8$,

$\therefore$ the numbers are $\pm 14, \pm 10, \pm 6, \pm 2$.

(*h*) The product of five numbers in A. P. is 945, and their sum is 25. What are the numbers?

Let $x + 2y$, $x + y$, x, $x - y$, $x - 2y$ be the numbers.

Then $5x = 25$, and $\therefore x = 5$.

Also $x(x+y)(x-y)(x+2y)(x-2y) = 945$,

$\therefore x(x^2 - y^2)(x^2 - 4y^2) = 945$.

Dividing by $x = 5$, we have,

$(x^2 - y^2)(x^2 - 4y^2) = 189$,

$\therefore x^4 - 5x^2y^2 + 4y^2 = 189$.

Substitute $x = 5$.

$\therefore 4y^4 - 125y^2 + 625 = 189$.

$\therefore 2y^2 = \frac{109}{2}$, or 8,

$\therefore y^2 = \frac{109}{4}$, or 4,

Discarding the first value.

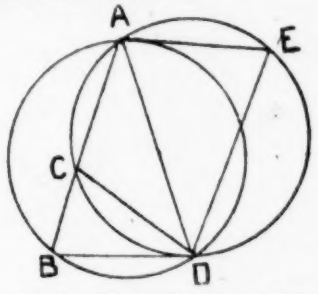
$\therefore y = \pm 2$.

$\therefore$ the numbers are, 1, 3, 5, 7, 9, or, taking the plus value, 9, 3, 5, 7, 1.

(*We will give a few examples in G.P. next month.*)

(*i*) In Proposition Euclid IV. 10, the circle round ACD equals that round ABD.

Construction—In circle ACD, on side remote from C, take any point E, and join AE and DE.



Proof.—$\therefore$ DC = DB $\therefore \angle$ DCB = $\angle$ DBC,

but $\angle$s ACD + DCB = 2 right angles,

$\therefore$ also $\angle$s ACD + ABD = ,, ,,

but $\angle$s ACD + AED = ,, ,, (III. 22),

$\therefore \angle$s ACD + ABD = $\angle$s ACD + AED,

$\therefore \angle$ ABD = $\angle$ AED,

$\therefore$ by Definition III. 13, and Prop. III. 24, circle ABD = circle ACD.—Q.E.D.

IV. School Management Hints.

(*a*) *Shew how a knowledge of the character of the children is of use in Class teaching.*

To the permanent teacher of any class, a knowledge of its children's character is absolutely essential if every child is to profit by class (not individual) teaching, is to benefit to the fullest extent, and if friction is to be minimised.

The (1) inert and sluggish must be stimulated; (2), the restless occupied; (3), the dishonest watched; (4), the quick given extra work; and (5), the plodder patiently handled.

If this knowledge be not possessed: (1), laziness from the inert; (2) indiscipline from the restless; (3), copying from the dishonest; (4), mischief from the quick; and (5), a sense of injustice in the plodder will result.

(*b*) *Notes of Lessons.*

In a recent circular Pupil-Teachers are directed, under the guidance of the Head-Teacher, to draw up one Notes of Lessons per week, say, forty-five per year. Now it is obviously best to draw up a scheme that will suit every pupil-teacher, whatever year he may be in, and these schemes may vary for each of the four years of apprenticeship.

We would recommend something like the following:—

1.	To Standard		I.	on Money.
2.	,,	,,	II.	,, Reading.
3.	,,	,,	III.	,, Writing.
4.	,,	,,	IV.	,, Dictation.
5.	,,	,,	V.	,, Composition.
6.	,,	,,	VI.	,, Reciting a given poem.
7.	,,	,,	VII.	,, Stocks.
8.	,,	,,	I.	,, Nouns.
9.	,,	,,	II.	,, Mental Arithmetic.
10.	,,	,,	III.	,, Mountains of England.
11.	,,	,,	IV.	,, Duke of Wellington.
12.	,,	,,	V.	,, Long Tots.
13.	,,	,,	VI.	,, Multiplication of Algebra.
14.	,,	,,	VII.	,, French Verbs.
15.	,,	,,	I.	,, Life of Joseph.
16.	,,	,,	II.	,, Clothing.
17.	,,	,,	III.	,, Constructing Sentences.

18. To Standard IV. on Scale Drawing.
19. ,, ,, V. ,, English Prefixes.
20. ,, ,, VI. ,, Musical Time.
21. ,, ,, VII. ,, The Common Pump.
22. ,, ,, I. ,, Subtraction.
23. ,, ,, II. ,, The manuscript capitals.
24. ,, ,, III. ,, Rules of Spelling.
25. ,, ,, IV. ,, Correctness of Speech.
26. ,, ,, V. ,, Moral Courage.
27. ,, ,, VI. ,, The duties of an Englishman.
28. ,, ,, VII. ,, Letter-writing.
29. ,, ,, I. ,, The manuscripts smalls.
30. ,, ,, II. ,, The Fourth Commandment.
31. ,, ,, III. ,, Long Division.
32. ,, ,, IV. ,, Analysis of Sentences.
33. ,, ,, V. ,, Addition of Fractions.
34. ,, ,, VI. ,, House of Commons.
35. ,, ,, VII. ,, Newspapers.
36. ,, ,, I. ,, Simple Rhymes.
37. ,, ,, II. ,, Short Division.
38. ,, ,, III. ,, Personal Pronouns.
39. ,, ,, IV. ,, Our Forefathers.
40. ,, ,, V. ,, Practical Geometry of Angles.
41. ,, ,, VI. ,, Mechanical Forces.
42. ,, ,, VII. ,, Shading from Casts.
43. ,, ,, I. ,, Towns.
44. ,, ,, II. ,, Truth in word and deed.
45. ,, ,, III. ,, Our Coal-fields.

(*c*) At the head of every Notes of Lesson it is well to state—
1. The Class to which it is to be given.
2. The Time to be taken.
3. The Knowledge presupposed.
4. The Apparatus to be employed.
5. The Objects of the Lesson.

V. Life of Thomas Moore.

Thomas Moore, the greatest Irish poet that has yet appeared, was the son of a Dublin grocer, and was born on 28th May, 1779.

His early childhood presents little worthy of notice. In due course he entered Trinity College, Dublin, but in 1800 proceeded to London to study law at the Middle Temple. The same year a translation of the 'Odes of Anacreon' was well received, and in 1801 he published a collection of licentious poems, under the pseudonym of 'The late, Thomas Little.' Meanwhile his law studies did not progress, and he was glad, in 1804, to accept from the patronage of Lord Moira the office of collector at Bermuda. Here he soon became disgusted, and having appointed a deputy, he made a tour through Canada and the United States, and returned to England after an absence of only ten months.

Two years later he published his 'Odes and Epistles,' a production also of an objectionable character, which was deservedly castigated by Jeffrey in the *Edinburgh Review*. A harmless duel between the poet and the reviewer was the consequence, commemorated by Byron in 'English Bards and Scotch Reviewers.'

From 1807 to 1834 he wrote for Powell, the music publisher, a number of magnificent lyrics to be set to Irish airs. These will ever cast lustre upon his name.

A separate series of 'National Airs,' and a collection of 'Sacred Songs,' issued from his pen in 1815.

Two years subsequently 'Lalla Rookh' appeared under the auspices of Messrs. Longman. For this Moore received 3,000 guineas.

In 1819 he became involved in serious financial straits through the peculation of his Bermudan deputy, but he managed to clear himself (as did Scott) by a noble exertion of his literary abilities.

His 'Life of Byron' appeared in 1830, and was acknowledged to be a biographical masterpiece, eclipsing even his 'Life of Sheridan,' which had been published five years previously.

His chief remaining works are 'The Blue Stocking,' 1811; 'Twopenny Post Boy,' 1812; 'Loves of the Angels,' 1822; 'The Summer Fête,' 'Memoirs of Lord Edward Fitzgerald,' 'Travels of an Irish Gentleman in search of a Religion,' and 'History of Ireland' (written for Lardner's Encyclopædia).

From 1835 he received a government pension of £300 per annum, and in 1850 £100 was further settled on Mrs. Moore.

Moore was always fond of rural and romantic scenery. For about five years (1812–1817) he lived at Mayfield Cottage, near Ashbourne, Derbyshire, where he revelled in the Peak scenery and in the beauties of Dovedale. At this period he wrote a beautiful poetical epitaph, still extant in Cheadle Churchyard, North Staffordshire.

The last thirty years of his life he resided at the cottage of Sloperton, near Devizes, adjacent to the mansion of the Marquis of Lansdowne. Here he died in February 1852, having for three rears been mentally incapacitated by softening of the brain. R.I.P.

VI. Model Answers.

ENGLISH LANGUAGE AND LITERATURE.

Men—First Year.

Answer the first five *questions, and* one only *of the* two *remaining questions.*

If you answer more than the prescribed number of questions, only that number of answers coming first on your paper will be revised.

1. Analyse the following passage :—

'I have given him the first quest : he is not proven.
Look, therefore, when he calls for this in hall,
Thou get to horse and follow him far away.
Cover the lions on thy shield, and see
Far as thou mayest, he is not ta'en nor slain.'

(*Gareth and Lynette*, lines 568–572.)

Sentence.	Kind of Sentence.	Subject.		Predicate.		Object.	
		Simple.	Enlarge.	Simple.	Extens.	Simple.	Enlarge.
A. I have given him the first quest	Principal.	I		have given		quest (*Direct*) him (*Indirect*)	the first
B. He is not proven	Principal.	He		is proven	not		
C.							
(1) Look, therefore, when he calls for this . . . follow him far away.	Principal, Complex.	[Thou]		look	when he calls for this in hall, therefore,	Thou get to horse and follow him far away	
(2) When he calls for this in hall,	Adv. of time, mod. *look.*	he	(when)	calls	for this in hall		
(3) Thou get to horse	Noun, gov. by *look.*	thou		get	to horse		
(4) [Thou] follow him far away.	,, ,, ,,	[thou]		follow	far away	him	

Sentence.	Kind of Sentence.	Subject.		Predicate.		Object.	
		Simple.	Enlarge.	Simple.	Extens.	Simple.	Enlarge.
D. Cover the lions on thy shield	Principal.	[thou]		cover		lions	the, on thy shield
E.							
(1) And see, far as thou mayest, he is not ta'en nor slain.	Principal, Complex.	[thou]		see	far as thou mayest	he is not taken or slain	
(2) he is not ta'en.	Noun, gov. by *see*.	he		is taken	not		
(3) or [he is] slain [not].	,, ,, ,,	[he]	(or)	is [slain]	[not]		
(4) as thou mayest [see].	Adv. of Degree, mod. *far*.	thou		mayest		[see]	

2. Parse the words in italics :—

'For *be* he *wroth* even to *slaying* me,
Far *liefer* by his dear hand *had* I *die*,
Than that my lord *should suffer* loss or shame.'
(*Geraint and Enid*, lines 67–69.)

be — Verb, copulative, irreg. (*am*, *was*, *been*), intrans., subjunct., pres., sing., 3rd, agrees with its subj. '*he*.'
wroth — Adj. of quality, posit. degree, qualif. '*he*' predicatively.
slaying — Gerund (*slay*, *slew*, *slain*), sing., 3rd, neu., obj., gov. by '*to*.'
liefer — Adv. of preference, comp. degree, mod. '*had*.'
had — Verb, reg. (contracted), trans., act., indic., pres. (idiomatic), sing., 1st pers., agrees with its subject '*I*' and gov. '*die*.' (cf. *would* as pres. tense.)
die — Verb, reg., intrans., infin., pres., gov. by '*had*.'
should — Verb, irreg., indeterminate, trans., act., subjunct., pres., sing., 3rd, agree. with '*lord*,' and gov. '*suffer*.'
suffer — Verb, reg., prolative, trans., act., infin., pres., gov. by '*should*,' and gov. '*loss*' and '*shame*.'

3. Explain the meaning of the following passages, and say by whom they were spoken :—

(1) 'Who walks through fire will hardly heed the smoke.'
(*Gareth and Lynette*, line 141.)

(2) 'Know ye not then the Riddling of the Bards?'
(*Gareth and Lynette*, line 280.)

(3) 'Have I not earned my cake in baking of it?'
(*Gareth and Lynette*, line 561.)

(4) 'Lion and stoat have isled together, knave,
In time of flood.'
(*Gareth and Lynette*, lines 871, 872.)

(5) 'As now men weed the white horse on the Berkshire Hills.'
(*Geraint and Enid*, lines 935, 936.)

(6) 'And oft I talked with Dubric, the high saint.'
(*Geraint and Enid*, line 864.)

(7) 'I love that beauty should go beautifully.'
(*Geraint and Enid*, line 680.)

(1) *Queen Bellicent* tells Gareth that if he be bent upon deeds of high emprise, he must not mind the obscurity and disagreeables of a lowly apprenticeship.

(2) An ancient man, long-bearded, *an old Seer*, replies to Gareth, saying that the 'Riddling of the Bards,' the ambiguous utterances of the minstrels, was—

'Confusion, and illusion and relation,
Elusion and occasion and evasion.'

(3) Merrily *Gareth* asked King Arthur, 'Have I not earned my cake in baking of it?' 'Have I not earned my living—done my duty—whilst discharging lowly services?' '*In baking*' imitates a French idiom; cf. *en passant*.

(4) *Lynette* answers Gareth that 'Necessity makes strange companions,' therefore will she fly him no more.

(5) This passage is NOT SPOKEN. King Arthur rooted out the slothful or guilty officer whom he found wanting, '*As now men weed*,' &c.

The *white horse* is the gigantic figure of a horse made (on the side of a hill by cutting away the turf and so leaving the white chalk exposed beneath) to commemorate Alfred's victory of Ashdown over the Danes in 871. The figure is 'scoured,' (weeded) to preserve its outlines. (*See Tom Brown's School-days*.)

(6) *Edryn*, perceiving Enid distrust him announces his reformation and its process.

Dubric is Dubritius, archbishop of Caerleon and primate of Britain, and legate of the apostolical see. He was so eminent for his piety that according to Geoffrey of Monmouth he could cure any sick person by prayer.

(7) The huge *Earl Doorm* wishes that for his pleasure Enid should array herself in choice apparel, as became her loveliness and his appreciation thereof.

4. (i) Comment upon the following words, as used by Tennyson :—(*a*) 'clomb,' (*b*) 'glamour,' (*c*) 'Mage,' (*d*) 'seized,' (*e*) 'tip-tilted,' (*f*) 'agaric,' (*g*) 'cate,' (*h*) 'marches.' (ii) Say what you know of the etymology and meaning of (*a*) 'purblind,' (*b*) 'stubborn,' (*c*) 'bandit,' (*d*) 'settle.'

(i) (*a*) *clomb*. (Gareth and Lynette, line 56.) This is a favourite method of forming the past tense of *climb*, both with Spenser and Tennyson. The late Laureate well knew when to use archaic forms.

(*b*) *glamour* (Gareth and Lynette, line 202) is a magical illusory influence over the sense. The derivation is probably from Icelandic *glam* = *vision*, or Danish *glimmer*, to *gleam*. Professor Skeat records that some think it to proceed from French *gramaire*, O.E. *gramarie*, the notion being that learning and magic were closely connected.

(*c*) *Mage* (Gareth and Lynette, line 279) = magician, from Latin *magus*, Greek μαγος.

(*d*) *seized* (Gareth and Lynette, line 351) = possessed of. The old French *seisir* meant 'to take possession of.' Hence our legal term *seisin*.

(*e*) *tip-tilted*. Lynette's nose was 'piquant,' as was her disposition. For *tip* cf. top; for *tilted*, A.S. *tealtian* = to totter, to raise up at the end.

(*f*) *agaric* (Gareth and Lynette, line 729) is the scientific name of that genus of fungi to which mushrooms belong. (Greek αγαρικον.)

(*g*) *cate* (Gareth and Lynette, line 828), generally used in the plural, means dainty provisions. From Low Latin *accaptare* = to purchase; French *achat*, *acat*. See also our verb *to cater*.

(*h*) *marches* (Gareth and Lynette, line 1008, Geraint and Enid, line 30) = borders, from A.S. *mearc*, Gothic *marka*. There were wardens of the Welsh and Scotch marshes.

(ii) (*a*) *purblind* (Geraint and Enid, line 1) from pure-blind = wholly blind; now means 'partly blind.'

(*b*) *stubborn* (Geraint and Enid, line 120), older form *stiborn*, arises from *styb*, the stump of a tree; cf. *stubble*, Danish *stub*, Dutch *stobbe*, &c. Its meaning generally is '*hard to move*,' but here, combined with '*shafted oaks*,' it means '*stumpy*'—stumpy-trunked oaks.

(*c*) *bandit* (Geraint and Enid, lines 30, 527, 817, &c.) = *outlaw*, from Italian *bandire* = to proscribe. The word was originally borrowed by Low Latin from the German; cf. *ban*, *banns*.

(*d*) *settle* (Geraint and Enid, line 572), from A.S. *selt* = a seat, with diminutive or frequentative—*le*, cf., German *sessel*. It is a long seat with a high back.

5. Illustrate, from the 'Study of Words,' what Trench means by the following passage :—

'Like some workman, who, being furnished for an operation that will challenge all his skill with a dozen different tools, each adapted for its own special purpose, should, in his indolence and

self-conceit, persist in using only one ; doing coarsely what might have been done finely ; or leaving altogether undone that which with such assistance was quite within his reach.' (Lecture VI. from 85 to 90 lines from end.)

Subtleties of thought require words with delicate shades of meaning, but we frequently use some general instead of the specific word.

The word *trick* (A.S.) is often employed for *device* (Italian), *finesse* (French), *artifice* (Latin), and *stratagem* (Greek) ; *arrogance* (L) for *presumption* (L) and *insolence* (L) ; *hate* (A.S.) for *loathe*, *detest*, *abhor*, &c.

Moreover, with some words we have not troubled authoritatively to differentiate, as in the case of *vengeance* and *revenge*, where the first should be applied to the work of God's righteous wrath, and the latter to man's evil passions.

Sometimes, through slovenliness, words such as *genuine* and *authentic*, *opposite* and *contrary*, *discovery* and *invention*, are confused. The importance of selecting the proper word is shown by the debate in 1688 upon whether James II. had *abdicated* or *deserted* the throne. If the former, it followed that he had no right to return ; if the latter, that he was bound to do so.

Finally, how great is the importance between properly distinguishing between the words *instruction* and *education !*

6. Quote any lines which illustrate Tennyson's accurate observation of nature.

(i) Gareth and Lynette, lines 184–193.

(ii) Geraint and Enid, lines 686–692.

All Tennyson's similes drawn from nature attest his minute delineation and accurate observation.

7. Give, in your own words, three similes from the 'Idylls of the King' which strike you as specially effective.

(i) Gareth and Lynette, lines 670–674.

As dun-clad chrysalids that slip off the sombre envelopes of their wings and shine forth radiantly scaled before their flight, so Gareth [casting off his cloak of coarsest texture] appeared resplendent in armour before he departed.

(ii) Geraint and Enid, lines 170–175.

Like one who, close to a leaping mountain-stream, can plainly distinguish, amidst the din of the cascade hard by, the measured roar of the farther distant cataract, so, above the clamour of the fight, the soldiers were accustomed to hear his voice.

(iii) Geraint and Enid, lines 468–477.

Tennyson depicts the summer morn, the clear channels with sandy bottom, the gently gliding fish whose shadows on the sand move twin-like beneath.* Then comes the uplifted hand, half transparent in the rays, and yet shadow-casting, the startled darting of the fish, and their instantaneous and total disappearance under the islets of flowering watercress.

Thus, says the poet, the associates of Earl Limours' drinking bouts vanished, scared by the mere movements of Geraint.

* Compare—'Then swan upon St. Mary's lake
Floats double, swan and shadow.'

ENGLISH LANGUAGE AND LITERATURE.

MEN—SECOND YEAR.

Answer the first five *questions, and one only of the* two *remaining questions.*

N.B.—If more than the prescribed number of questions are answered, only that number of answers coming first on the paper will be revised.

1. Paraphrase the following passage :—

To be thus is nothing ;
But to be safely thus. Our fears in Banquo
Stick deep ; and in his royalty of nature
Reigns that which would be feared ; 'tis much he dares,
And to that dauntless temper of his mind,
He hath a wisdom that doth guide his valour
To act in safety. . . . . .
. . . . . If't be so,
For Banquo's issue have I filed my mind ;
For them the gracious Duncan have I murdered ;
Put rancours in the vessel of my peace
Only for them ; and mine eternal jewel
Given to the common enemy of man,
To make them kings, the seed of Banquo kings ;
Rather than so, come, fate, into the list,
And champion me to the utterance !

Macbeth, lines 58–64, and 63–71, Act III., Scene 1.

Merely to reign avails naught, but to reign in security is another matter.

I am thoroughly afraid of Banquo, for he is of that kingly disposition which necessarily inspires dread.

He is of great bravery, and to this invincible character he unites a discretion which leads his courage to successful issues. . . . .

If, after all, he is to be the ancestor of kings, then it is for his descendants [and not mine] that I have polluted my spirit by foully slaying the virtuous Duncan, have embittered my life, and have sold my precious soul to the devil—and this, to enthrone his posterity !

Sooner than permit this, [I will dare everything] ; I will fight *à outrance* Destiny itself.

2. (*a*) Analyse the following passage :—

Then Enid pondered in her heart, and said,
'I will go back a little to my lord,
And I will tell him all their caitiff talk ;
For, *be* he wroth even to *slaying* me,
Far *liefer* by his dear hand *had* I *die*
Than that my lord should suffer loss or shame.'

Geraint and Enid, lines 64–69.

Sentence.	Kind of Sentence.	Subject.		Predicate.		Object.	
		Simple.	Enlarge.	Simple.	Extens.	Simple.	Enlarge.
A. Then Enid pondered in her heart	Principal	Enid	(then)	pondered	then, in her heart		
B. (i) and [she] said 'I will go . . . . my lord should suffer loss or shame	Principal, Complex	[she]	(and)	said		rest of sentence	
(ii) I will go back a little to my lord For, be he wroth . . . . loss or shame	Noun, gov. by *said*	I		will go	back a little . . . . . loss or shame		
(iii) And I will tell him all their caitiff talk, For . . . . loss or shame	Noun gov. by *said*	I	(and)	will tell		talk (*direct*) him (*indirect*)	all their

Sentence.	Kind of Sentence.	Subject.		Predicate.		Object.	
		Simple.	Enlarge.	Simple.	Extens.	Simple.	Enlarge.
(ii) and (iii) (*a*) For, be he wroth even to slaying me . . . . loss or shame	Adv. of reason, mod. *go* and *tell*	I		had	liefer than that my lord, etc., be he wroth even to slaying me	[to] die	by his dear hand
(ii) and (iii) (*a*) (1) than that my lord should . . . . loss or shame.	Adv. of degree, mod. *liefer*	lord	(than that) my	should		[to] suffer loss or shame	
(ii) and (iii) (*a*) (2) be he wroth even to slaying me	Conditional adv., mod. *had*	he		be wroth	even to slaying me		

(*b*) Give grammatical notes on the words in italics.

be — Verb, irreg., copulative, intrans., condit.-subj., pres., sing., 3rd, agrees with subj. '*he*.' '*Be he*' = '*if he be*.'

slaying — Gerund, (*slay, slew, slain*), sing., 3rd, neut., obj., gov. by '*to*.'

liefer — Adv. of preference, comp., mod. '*had*.'

had — Verb, regular, (contracted), trans., act., indic., pres., sing., 1st, agrees with '*I*,' and gov. '*die*.' The verb *had*, like the verbs *would* and *should*, has in this idiomatic usage a Præterito-Presentia meaning. It is also used indeterminately.

die — Verb, regular, intrans., infin., pres., gov. by '*had*.'

3. Comment on the following passages in the play :—

(*a*) Sleep, that knits up the ravelled sleave of care.
Macbeth II., ii. 37.

(*b*) Blood hath been shed ere now, i' the olden time,
Ere humane statute purged the gentle weal.
Macbeth III., iv. 75, 76.

(*c*) If trembling I inhabit then, protest me
The baby of a girl.
Macbeth III. iv. 105, 106.

(*d*) *Macduff.*—What's the disease he means ?
Malcolm.— 'Tis called the evil.
Macbeth IV., iii. 146.

(*e*) Go prick thy face and over-red thy fear,
Thou lily-livered boy. *Macbeth* V., iii. 14, 15.

(*a*) *Ravelled* = *tangled*, from old Dutch *ravelen*, to *ravel*. To unravel is commonly used.
Sleave = *floss silk;* cf. Danish *slöife*, a loose knot.
The whole meaning is 'Sleep that disentangles the mental perplexities which care has involved.'

(*b*) *Humane* and *human* were not distinguished in Shakespeare's time, either by spelling or pronunciation.
Gentle here is used proleptically. *Weal* = (common)*wealth*, from A.S. *wela* = prosperity.
The shedding of blood was not called 'murder' until mankind enacted laws and made the commonwealth gentle.

(*c*) This a most vexed passage, of which numberless corrections have been suggested. Probably 'If I dwell in trembling, then declare that I am a girl's doll,' is the best interpretation. *Inhibit* for *inhabit*, *here* for *then*, are sometimes read. '*The baby of a girl*' has been rendered '*The weakly child of a young girl*'; '*A babyish girl*.'

(*d*) '*The evil*,' the king's evil = scrofula. From Edward the Confessor even to Dr. Johnson, whom Queen Anne 'touched,' the power of curing this disease was ascribed to the English sovereigns. This passage, which nowise assists the drama, is obviously introduced to compliment James I.

(*e*) The liver was looked upon as the seat of courage, and a white or bloodless liver was a metaphor for cowardice. (See ii. Henry IV. iv. 3, 113.)
The servant, alike pale-faced and white-livered, is told to draw blood into his face, and to smear his cheeks to hide his pallor.

4. (i) What is the purpose of each of the Idylls you have been studying ?

(ii) Give such explanatory notes as you think necessary on the following :—

(*a*) 'And the live green had kindled into flowers.'
Gareth and Lynette, line 182.

(*b*) 'A spear of grain
Storm-strengthened on a windy site.'
Gareth and Lynette, lines 676, 677.

(*c*) 'The flower
That blows a globe of after-arrowlets.'
Gareth and Lynette, lines 1,002, 1,003.

(*d*) 'Molten down in mere uxoriousness.'
Marriage of Geraint, line 60.

(*e*) 'A happy mist
Like that which kept the heart of Eden green
Before the useful trouble of the rain.'
Geraint and Enid, lines 768 to 770.

(*f*) 'Betwixt the cressy islets white in flower.
Geraint and Enid, line 475.

(i) (*a*) *Gareth and Lynette* plays a large part in the design of the meaning of the Idylls taken as a whole—in the showing '*Sense at war with Soul*.'
The grosser sensual taint has not yet become visible (Guinevere is neither mentioned nor alluded to). Bellicent's allurements to home comforts, Gareth's companions' doubts of the reality of Camelot, Lynette's inability to discern lowly worth, depict the conflict of ease versus honour, faith versus sight, and birth versus worth—all phases of Sense versus Soul.
But, above all, the allegory of Gareth's various combats and successive victories betokens the Soul triumphant over all foes, and finally over Death itself.

(*b*) *Geraint and Enid* (with the 'Marriage of Geraint') has a unity of its own comparatively independent of the general Idyllic scheme, yet contributing somewhat to the progress of the design.
It subtly shows the gradual declension of virtue and trust, and the insidious approach of vice. It fitly bridges over the chasm between '*Gareth and Lynette*' and *Balin and Balan* and *Vivien*, which follow, and which painfully show the advent of corruption and moral taint. The scandal respecting Lancelot and Guinevere is as yet but vicious leaven working in secret, and producing a vague uneasiness in restful souls, and false suspicions against the purest and truest.
Yet at present all is not lost : Edyrn is even converted, nay the Queen herself bears a part in this work ; yet the little rift that will silence all, and the little speck that will moulder all, are beginning their fatal work.
'All is not well' is the pervading tone, though we still have an Enid to counterpoise a Guinevere and a Vivien.

(ii) (*a*) This line denotes the time of the year, 'for it was past Easter day.' The season is also in accord with Gareth's development into manhood. The metaphor, *kindled*, is very picturesque.

(*b*) The texture or grain of a tree that battles with the wind is tougher than usual. *Storm-strengthened* is one of Tennyson's nervous 'compounds' in the Shakespearian style. Such usages have distinctly assisted the agglutiveness of English.

(*c*) Probably the yellow dandelion, whose seeds are winged like tiny arrows. After the petals are fallen, the flower becomes a globe of 'arrowlets.' The 'Noon-day Sun's' shield was golden-yellow and round.

(*d*) *Uxoriousness* (L. *uxorius* = foolishly fond of a wife) ; *mere* (L. *merus* = unmixed).

Arthur's iron valour is represented as melted into pure effeminacy through foolish fondness for Guinevere. Tennyson used both of the forms *melted* and *molten*.

N.B.—Is not this question beyond the syllabus?

(*c*) Tears are often compared to rain, and Tennyson happily introduces a kindred simile by resembling moistness of the eye to mist. Enid's happiness was too deep and placid to be *troubled* with tears, useful as these are in relieving the over-charged heart.

The allusion is to Genesis ii. 5, 6, where, before God caused it to rain, 'there went up a mist from the earth and watered the whole face of the ground.'

Rain is, of course, often violent and excessive.

(*f*) In such 'crystal dykes' watercress flourishes; and, as it was summer, would form patches and would bloom into whiteness.

5. State briefly what Archbishop Trench says about 'the Rise of New Words.'

This question being interpreted means 'Give a Synopsis of all Lecture V.'

Of some words we can accurately locate the time, and of others only the period of their birth.

Some ecclesiastical, historical, and geographical words are in some sort epoch-making, *e.g.*, *Christian*, *Frank*, *America*.

The cause of new words is their necessity. When language is inadequate to express concisely new ideas, new wants, new courses of action, new discoveries, new inventions, etc., it overflows its ancient channels and runs in new courses, and such words as *Saviour*, *beatitude*, *dragonnade*, *potato*, appear.

Some words (*Roundhead*, *caucus*, etc.) seem to arise spontaneously from the bosom of the people, whilst others (*cosmopolite*, *indolentia*, etc.) are deliberately coined by ingenious men.

The former class possesses the most vitality, for not every word (see Cicero's *mulierositas*, Coleridge's *esemplastic*), which even a master of language proposes, finds acceptance.

Conciseness is often gained by the introduction of such words as *isothermal* and *atavism*, which render to science immense services.

The principle of 'the survival of the fittest' applies to words. No amount of authority or of learning can of itself assure the currency of any term. The French Academy, despite resistance and procrastination, has had repeatedly to open the pages of its dictionary to some despised word of popular use.

Words are not only the vehicles of thought, but its nutriment, clarification, and stimulant. New words, therefore, are not only convenient, but are frequently fertile in mental advancement.

6. Contrast Tennyson's story of 'Gareth and Lynette' with that of Sir Thomas Malory in 'Morte D'Arthur.'

The story of the first 430 lines of 'Gareth and Lynette' up to his appearance before the king are Tennyson's own invention, but from this point he follows Sir T. Malory's main features. In the poem Gareth serves as a scullion for only a month instead of a year; is knighted by the king instead of by Lancelot, and puts to flight six thieves instead of slaying them. Gareth next overcomes '*The Morning Star*,' not the '*Black Knight*.' This nearly corresponds with the encounter with Malory's '*Green Knight*.' The next fight, that with '*The Noonday Sun*,' answers to the first in Malory, viz., that with the elder of the two brothers at the ford. To the battle with '*The Evening Star*,' there is in the 'Morte D'Arthur' no near parallel, whilst that with '*Night and Death*' is the poet's own conception, as are also many of the incidents of the other encounters.

We have in the poem but three combats with knights before reaching *Castle Perilous*, instead of five.

The other deviations are, the different reason for Gareth's lowly service, the shortening of the period of action, the suggestion of Lynette's marriage to Gareth, the serious and deadly (not aimless and courtly) character of the contests, the touches of sentiment in the relations between Gareth and Lynette, and the transfer of the combat with Lancelot from an earlier to a later stage.

7. Trace the origin of the following words:—(*a*) Gothic; (*b*) sacrament; (*c*) stipulation; (*d*) expense; (*e*) queen; (*f*) palace.

(*a*) *Gothic* was at first a mere random term of contempt, which did not exist, as applied to architecture, until centuries after the disappearance of the Goths. The admirers of the classical Italian school meant thereby *rude* and *barbarous*.

(*b*) (1) *Sacramentum* was the pledge which, under Roman law, certain losers of suits had to forfeit to temple uses. (L. *sacer* = sacred.)

(2) Next it was applied to the military oath of the Roman soldier.

(3) Then it widened to mean any solemn oath.

(4) Lastly, the church has claimed it for certain solemn means of grace, in which it still retains the ideas of a sacred and a militant pledge.

(*c*) Two Romans would break a *stipula* (straw) between them as signs of an agreement. From this custom, it is said, arose the word *stipulatio(n)*.

(*d*) *Expense* is from L. *ex* = out, *pendo* = I weigh, *expendo* to weigh out money. The word embalms the ancient custom of paying money by weight, not tale. (See Genesis xxxiii. 16.)

(*e*) *Queen* is a form of A.S. *cwen* = a woman or wife. It is probably distinct in derivation from *quean* (Dutch *queen* = a barren cow, Low German *quene* = a heifer).

It probably owes its regal use (as compared with the royal terms derived from Norman-French), to the marriage of Henry I. with the Saxon Maud.

(*f*) *Palace* (French *palais*) is from L. *Palatium*, one of the Roman hills whereon stood the mansion of Augustus, with other splendid edifices.

8. Show the distinction between our use of (*a*) 'revenge' and 'vengeance,' (*b*) 'famine' and 'hunger.'

(*a*) *Vengeance* should denote the moral act, the just punishment of the sinner by his God, or of the criminal by his judge.

(*b*) *Revenge* ought to mean the immoral act of, or passion for, retaliation of one who counts himself injured or offended.

VII. We have made arrangements, merely to suit our own Readers, and with no desire to interfere with existing agencies, for *tuition* based upon these articles, routines, and questions by experienced teachers and graduates. Names of intending pupils should be sent to Dr. G. BEACH, M.A., *Stanley Mount, Macclesfield*. The fees, *to be paid in advance*, are 1s. 6d. per paper, 2s. 9d. per month, 8s. per quarter, or £1 5s. the course.

VIII. An immense quantity of CERTIFICATE HELP is now being given both in the 'GIRLS' MISTRESS' and 'INFANTS' MISTRESS' by Miss C. J. Dodd, Lecturer on School Method and Domestic Economy at the Day Training College Department, Owens College, Manchester.

IX. PARSING, ANALYSIS, AND PARAPHRASING, FOR ROUTINES.

A.—FIRST YEAR.

(*a*) *First Friday* (Men). 'Passing of Arthur,' Lines 1 to 8 for Analysis. Parse *which*, *made*, *when*, *more*, *than*, *voice*, *faces*, *other*, *For*, *westward*, *Heard*.

(*b*) *First Friday* (Women). 'The Princess,' Canto V., Lines 10 to 21 for Analysis. Parse *Entering*, *half-blind*, *As*, *when*, *each*, *titter*, *clamouring*, *etiquette*, *to wag*, *flashed*, *Squire*.

(*c*) *Third Monday* (Men). 'Passing of Arthur,' Lines 65 to 74 for Analysis. Parse *Far*, *battle*, *Whereto*, *than*, *mine*, *To war*, *himself*, *they*, *stroke*, *dead*, *as death*.

(*d*) *Third Monday* (Women). 'The Princess,' Canto VI., Lines 1 to 13 for Analysis. Parse *had died*, *As*, *Seeing*, *Thd*, *if*, *all*, *so*, *that*, *as*, *having seen*, *For*, *strange*, *is slain*.

(*e*) *Fourth Monday* (Men). 'Passing of Arthur,' Lines 139 to 146 for Analysis. Parse *that*, *whereon*, *beats*, *dead*, *as*, *tho'*, *Bedivere*, *for*, *Confusion*, *till*, *what*, *whence*, *whether*.

(*f*) *Fourth Monday* (Women). 'The Princess,' Canto VII., Lines 1 to 13 for Analysis. Parse *So*, *violated*, *first*, *by-and-by*, *other*, *Hung*, *till*, *To gather*, *became*, *treble*, *fro*, *like*.

B.—SECOND YEAR.

(*a*) *First Wednesday* (Men). 'Hamlet,' Act III. Scene ii., Lines 181 to 189 for Analysis. Parse *need*, *tell*, *what*, *all*, *lord*, *as*, *But*, *fit*, *after*, *all*, *entreat*, *round*, *please*, *best*.

(*b*) *First Wednesday* (Women). 'Coriolanus,' Act III., Scene ii., Lines 119 to 130 for Analysis. Parse *More worthier*, *than*, *voices*, *resting*, *pressed*, *thread*, *gratis*, *Being*, *wherein*, *unborn*, *could*.

(*c*) *Second Wednesday* (Men). Paraphrase Lines 9 to 20 of 'Passing of Arthur.'

(*d*) *Second Wednesday* (Women). Paraphrase 'Coriolanus,' Act III., Scene ii., Lines 52 to 64.

(*e*) *Third Monday* (Men). Paraphrase Lines 240 to 249 of 'Passing of Arthur.'

(*f*) *Third Monday* (Women). Paraphrase 'Coriolanus,' Act III., Scene iii., Lines 120 to 133.

(*g*) *Fourth Monday* (Men). Lines 335 to 343 of 'Passing of Arthur' for Analysis. Parse *saying*, *half*, *reclining*, *As*, *Hem*, *would*, *but*, *not*, *took*, *both*, *his*, *drew*, *rising*, *place*.

(*h*) *Fourth Monday* (Women). 'Coriolanus,' Act IV., Scene i., Lines 44 to 54. Parse *ye*, *art*, *too*, *rove*, *unbruised*, *bring*, *but*, *friends*, *forth*, *While*, *still*, *aught*, *what*, *like*, *me*.

SELECTED GOVERNMENT QUESTIONS.

FIRST YEAR CANDIDATES.

First Week.

1. Write in Largehand the words '*Crystal Dewdrops.*'
Write in Smallhand the words '*Drawn from froth of Evil's foam,*
Folly springs the foe of Good.'

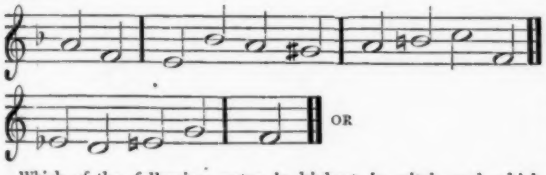
2. Write from Dictation :—

Prince Charles's journey to Madrid had revealed to those around him the strange mixture of obstinacy and weakness in his character, the duplicity which lavished promises because it never purposed to be bound by any, the petty pride that subordinated every political consideration to personal vanity or personal pique. He had granted demand after demand, till the very Spaniards lost faith in his concessions. With rage in his heart at the failure of his efforts, he had renewed his betrothal on the very eve of his departure, only that he might insult the Infanta by its withdrawal when he was safe at home. But to England at large the baser features of his character were still unknown. The stately reserve, the personal dignity and decency of manners, which distinguished the Prince, contrasted favourably with the gabble and indecorum of his father.

3. Give an outline of a lesson on '*The Eye, its structure and uses.*'

4. In grouping together a large number of words, having in them a common element (for example, words ending in *tion*), what generalization could be made, and how far could the scholars be helped to make this generalization for themselves? Show the value of such an exercise.

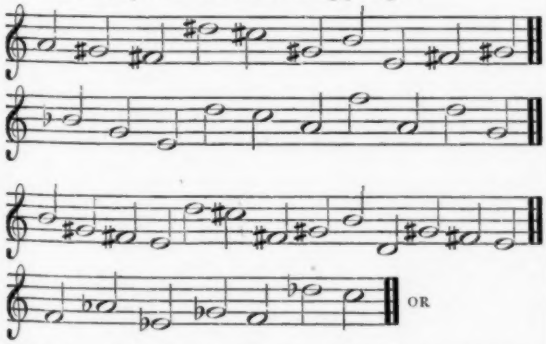
5. Transpose the following a major third higher, viz., into the key of A. :—



Which of the following notes is highest in pitch and which lowest? :—

(*a*) **t**, in Key B♭ (*d*) **l** in Key G
(*b*) **r** in Key D (*e*) **f** in Key A
(*c*) **s** in Key C (*f*) **l** in Key E

6. State the key of each of the following passages :—



State the sol-fa name (as *doh, fah,* etc.) of the following major scale relations :—

(*a*) Dominant. (*d*) Supertonic.
(*b*) Mediant. (*e*) Submediant.
(*c*) Leading-note. (*f*) Tonic.

7 to 10. Parsing, Analysis, and Composition from Routine.

11. Maps from routine.

12. Explain fully why all places lying in the same latitude have equal length of day and night, while all places in the same longitude have mid-day at the same time, and show why the frigid zones are for a certain period of the year involved in continual night or continual day.

13. (*Men.*) Contrast as far as you can the physical geography of Canada and Australia ; OR,

(*Women.*) What parts of Hindostan are excluded from the term '*British India,*' strictly so called? Describe the positions of Hurdwar, Cawnpore, Benares, Arcot, Surat, and Bombay.

14. Of whom was the Witanagemot composed? What were its powers? Give the derivation of the word '*king.*'

15. (*Men.*) Give some account of the state of affairs in Scotland between the years 1640 and 1650.

(*Women.*) Give the chief provisions of Magna Charta which had a permanent interest affecting (*a*) Feudalism, (*b*) Taxation.

16. A quantity of tea was sold for 4s. 2d. per lb. at a gain of 10 per cent. If the total gain was £12, what quantity of tea was sold? Ans. 633⅓ lbs.

17. (*Men.*) The sum of the squares of the extremes of four numbers in arithmetical progression is 200, and the sum of the squares of the means is 136. What are the numbers?
Ans. ± 14, ± 10, ± 6, ± 2.

(*Women.*) The quotient of an operation in division is 515,450, and the divisor is to the quotient as 9 : 65. Find the dividend.
Ans. 36,787,666,500.

18. (*Men.*) The sum of the first and second of four numbers in geometrical progression is 15, and the sum of the third and fourth is 60. Required the number. Ans. 5, 10, 20, 40.

(*Women.*) Cut out in lined paper and make up a woman's chemise half-size.

19. (*Men.*) A circle of 10 inches radius is to be divided into three equal parts by concentric circles. Find the length of their radii.
Ans. $\frac{10}{\sqrt{3}}$, $\frac{10\sqrt{2}}{\sqrt{3}}$.

(*Women.*) What are silk, cotton, and wool, and what are the chief merits of each material? How ought woollen garments to be washed?

20. (*Men.*) Write out Euclid I. 48.
Show how to make a square equal to the sum of three squares.

(*Women.*) Name some foolish fashions in women's dress, and show how they may injure the health, and interfere with the comfort of those silly enough to adopt them.

21. (*Men.*) Prove Euclid III. 12.
If two circles touch externally at P, prove that the straight line, joining the extremities of two parallel diameters towards opposite parts, passes through P.

Third Week.

(*Men.*)

1. Give a short account of the Life of Bacon, and mention his principal works.

2. Compare the diction of Bacon's Essays with present-day English. What illustrations can you give of the changes which our language has undergone in respect of (*a*) construction, (*b*) usage of particular words in the course of the last two centuries?

3. Explain (*a*) 'Revenge is a kind of wild justice,' (*b*) 'There is yet some good in public envy,' (*c*) 'The four pillars of government,' (*d*) 'Votary resolution is made equipollent to custom.'

4. Derive the following :—*Distilled, enfranchise, seeled, piquant, sequester, triumvirate, epicycles,* and *pedigree.*

5. Explain, as to a class, the grammatical terms *enlargement of subject, extension of place, irregular verb, noun in apposition,* and give two illustrations of each.

6. Write an Essay on 'Anger is short madness.'

7. Give illustrations of the Figures of Speech commonly used in poetry.

8. Comment on '*A doubtful throne is ice on summer seas,*' '*flame colour, vert and azure,*' '*riddling triplets,*' '*God fulfils himself in many ways.*'

9. What do you know of Leodogran, Ulfius, Merlin, Bedivere, Excalibur, and Lyonnesse?

10. What is the general design of the *Idylls of the King?*

Third Week.

(*Women.*)

1. Write a short Life of Byron and mention his principal works.

2. Comment upon '*All the fairies save one had been bidden to his cradle.*'

3. What do you know of '*Jedwood justice,*' '*Capreæ,*' '*Rant like that of Maximin,*' '*Moss-troopers*'?

4. What are the chief excellences and defects of Byron's poetry?

5. As for Men.

CERTIFICATE ROUTINE FOR APRIL 1894 (MEN AND WOMEN, FIRST YEAR).

DAYS	FIRST WEEK.			SECOND WEEK.			THIRD WEEK.			FOURTH WEEK.		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
MONDAY	Notes of a Spelling Lesson to Standard III.	Read Bacon's Essays, 32, 36, 38 *or* pp. 61 to 80 of Macaulay's Essay	Euclid, Book III., Props. 8 to 15 *or* Repairing Underclothing	Rewards and Punishments	Read Bacon's Essays, 39, 50 *or* pp. 99 to 114 of 'Princess' (Notes)	Euclid, Book III., Props. 16 to 24 *or* Paper Pattern of a Pair of Drawers	Sequence of Intellectual Development	Analyse, etc. *(See Article)*	Euclid, Book III., Props. 25 to 31 *or* Any Needlework	The Range of the Teacher's Influence	Analyse, etc. *(See Article)*	Drawing *or* Science
TUESDAY	Chief Dates from 1603 to 1660	Problems involving Quadratics *or* Composition of Food	Political Geography of Western United States *or* Geography of Arabia and Persia	Chief Dates from 1660 to 1688	Ratio and Proportion of Algebra *or* Cleansing of Clothing	Latitude and Longitude, with Problems thereon	Tables of the Battles of the 'Wars of the Roses' and 'The Great Rebellion'	Evolution and Variation of Algebra *or* Warming and Lighting of the Home	Political Geography of Southern United States *or* Geography of South-Eastern Asia	Chief Dates from 1688 to 1714	Problems on Simple Equations *or* Processes of Respiration, etc.	Distribution of Animals
WEDNESDAY	English Composition on 'The Fusion of Races'	History from 1603 to 1660	Mensuration of the Square *or* Mental Arithmetic	Percentages	Drawing	Mensuration of Rectangles *or* Compound Proportion	Theory of Practice and Proportion	Drawing	Discount	Work Examination Questions in Arithmetic	Drawing *or* Science	Geography of Mexico *or* Geography of Central Asia
THURSDAY	History from 1642 to 1651 *or* Growth of our Navy	Problems involving Quadratics *or* Nutritive Value of Food	Physical Map of British N. America *or* Map of Palestine	History from 1660 to 1688	Involution and Evolution of Algebra *or* Clothing Outfits	Effects of Climate on National Character	Constitutional Affairs from 1066 to 1215	Simultaneous Simple Equations *or* Cleaning Rooms and Furniture	Political Map of British N. America *or* Map of China	History from 1688 to 1714	G.C.M. and L.C.M. of Algebra *or* Ventilation	Drawing *or* Science
FRIDAY	Drawing	Deductions on Euclid, Book I. *or* Diagram of a Pair of Drawers for a Child of Five	Analyse, etc. *(See Article)*	Profit and Loss	Read pp. vii. to xxi. 'Coming of Arthur' (General Introduction) *or* pp. i. to x. of 'Life of Byron'	How to train the Hand	Notes of a Lesson in Free-hand Drawing to Standard IV.	Deductions on Euclid, Book II. *or* Cutting out of a Woman's Chemise	Read pp. xxiii. to xliii. 'Coming of Arthur' (Introduction) *or* pp. xi. to xvi. 'Life of Byron'	Mensuration of Parallelograms *or* Present Worth	How to Teach Grammar *or* 'Form'	Read First Half of 'Coming of Arthur' *or* pp. 115 to 130 of 'Princess' (Notes)
SATURDAY	Music, Signatures of the Simple Times, *or* 2, 3, and 4 pulse measures	Science	Examination *(Two Hours)*	Music, All the Major Scales, *or* Mental effects of Notes	Science	Examination *(Two Hours)*	Music, Contents of Measures	Science	Examination *(Two Hours)*	Musical Terms in Common Use	Drawing *or* Science	Examination *(Two Hours)*

CERTIFICATE ROUTINE FOR APRIL 1894 (MEN AND WOMEN, SECOND YEAR).

DAYS	FIRST WEEK.			SECOND WEEK.			THIRD WEEK.			FOURTH WEEK.		
	I	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
MONDAY	Jevons' Logic, first 22 pp. *or* Cartwright's 'Mental and Moral Science'	Read 'Hamlet,' Act V. *or* 'Coriolanus,' Act III., Scenes i. and ii.	Revise Euclid, Book III. *or* Tucking and Marking with Cross Stitch	The influence of Cleanliness and Method upon Health of Teachers and Schools	Deductions on Euclid, Book III. *or* Diagram of a Woman's Nightdress	Read 'Coming of Arthur' *or* 'Spenser,' Chapter I.'	'Quick,' Chapter XVI.	Deductions on Euclid, Book II. *or* Hedge-tear and Cross-cut Darns	Paraphrase. (*See Article*)	Drawing *or* Science	Deductions on Euclid, Book I. *or* Write down Directions for Making a Woman's Nightdress	Analyse, etc. (*See Article*)
TUESDAY	Chief Dates from 1527 to 1583 *or* Revision	Continued Fractions *or* Stocks	As in First Year — General Physical Geography of England	History as in First Year *or* From 1509 to 1532	Discount and Present Worth	As in First Year — Commercial Geography of England	Rewards and Punishments; Emulation and Example	Stocks	As in First Year — Political Geography of England	History as in First Year *or* Lives of Warriors from 1485 to 1547	Proofs of Fractional Operations	As in First Year — Physical Geography of Scotland
WEDNESDAY	Analyse, etc. (*See Article*)	Binomial Theorem *or* Bread and Paste Making	Drawing *or* Science	Paraphrase. (*See Article*)	Notes of a Lesson on Simple Analysis to Standard V. *or* On the Square (for Infants)	Binomial Theorem *or* Puddings for the Sick	Mensuration *or* Any Revision	Logarithms *or* How to Detect Food Adulteration	Chief Dates from 1588 to 1640 *or* Social History from 1485 to 1547	Jevons' Logic, pp. 22 to 37 *or* Cartwright's 'Mental and Moral Science'	Algebraic Ratio and Proportion *or* Utilisation of Scraps of Food	Drawing *or* Science
THURSDAY	As in First Year *or* History from 1485 to 1509	Problems on the Work of Mixed Agents	As in First Year — Political Map of Australia	As in First Year *or* From 1532 to 1547	Equation of Payments	As in First Year — Geography of Australia	As in First Year *or* Lives of Statesmen from 1485 to 1547	Averages	As in First Year — Map of New Zealand	As in First Year *or* Religion and Legislation from 1485 to 1547	Surds *or* Compound Proportion	As in First Year — Geography of Ireland
FRIDAY	Binomial Theorem *or* Diet for Convalescents	Euclid, Book VI., first 5 Props. *or* Diagram of a Woman's Nightdress	Ventilation and Water-supply of School Premises	Roots of Quadratics *or* Proper Seasons for the various meats	Euclid, Book VI., first 11 Props. *or* Cutting-out of a Child's Muslin Pinafore	Drawing *or* Science	Logarithms *or* Ordinary Beverages	Euclid, Book VI., first 17 Props. *or* Making of a Child's Muslin Pinafore	Read Bacon's Essays, 18, 19, 21, 24 *or* 'Spenser' Chapter II.	Algebraic Surds *or* Symptoms of the Ordinary Diseases	Euclid's Def. Axioms, etc., of first 6 Books *or* Making of a Child's Muslin Pinafore	Drawing *or* Science
SATURDAY	Drawing	Science	Examination (*Two Hours*)	Drawing	Science	Examination (*Two Hours*)	Drawing	Examination (*Two Hours*)	Science	Drawing	Examination (*Two Hours*)	Science

6. Write a short essay on '*The Dramatic Unities.*'

7. As for Men.

8. Say what you know about the origin, structure, and meaning of these words:—*Hatred, disastrous, blacken, expunge, secret, fared.*

9. Sketch the character of Ida. What was her aim?

10. What parts do Psyche, Blanche, and Melissa play in '*The Princess*'?

SECOND YEAR.

First Week.

1. As in First Year.

2. As in First Year.

3. A boy comes to school for the first time on January 10th, and leaves the neighbourhood without expectation of return on March 10th. During these months he stays away on some days from illness, on others from truancy. On 10th May he returns with the expressed intention of remaining for another year at school, but he goes out to work for the three summer months. Then he becomes recognised as a half-timer, and continues alternately at work and at school till he finally leaves on 10th December.

(*a*) Give all the entries that should be made for such a boy both in Admission and Class Registers.

(*b*) Show how the average of a school whose meetings were 400 in number would be affected by the presence of 10 such boys attending for a period equivalent to 12 weeks each during the year.

4. What are the processes of thought involved in (*a*) the classification of objects; (*b*) the use of an abstract noun; and (*c*) the use of a syllogism?

5. As in First Year; OR
Rewrite the following, halving the value of each note and rest:—

(*a*) | m : - .f | s .t_1 : d ||

(*b*) | s : — | — : m .f ||

(*c*) | r .f : r, f, l : s ||

(*d*) | s .f : | s .f : — | s : f ||

6. Note tests for Division IV. in schools include:—'*A simple passage, in a major key, containing accidentals to raise the fourth of the scale (approached by the third or fifth) and to flatten the seventh (approached by the key-note) properly contradicted.*'
Write two passages, one in D major and one in B♭ major, of about 20 notes each, in accordance with these requirements. Write a semibreve for each note, and do not add bars; OR
Fill up two measures each in two-pulse, three-pulse, and six-pulse time. Use at least 10 notes in each two measures. Begin each measure with a strong accent. Vary the contents of the measures in each time.

7 to 10. Parsing, Analysis, and Paraphrasing from routine.

11. Maps from routine.

12. (*Men.*) As in First Year.

(*Women.*) What were the chief causes which prompted the Government of Queensland to annex New Guinea? Describe the system by which the Australian colonies obtain a supply of labourers.

13. (*Men.*) As in First Year.

(*Women.*) Describe minutely the basin of the Murray.

14. (*Men.*) As in First Year.

(*Women.*) Trace the descent of Lady Jane Grey, Lord Darnley, and Lady Arabella Stuart from Henry VII.

15. What were the following years noted for:—1600, 1588, 1572, 1558, 1549, and 1541?

16. (*Men.*) How many different permutations can be made of the letters in the word '*Barabbas*' taken all together? Ans. 1,120.

(*Women.*) Find the value of $\frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}} - \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+3}$ to three places of decimals. Ans. 7·745.

17. (*Men.*) In how many ways can a party of six take their places at a round table? Ans. 60.

(*Women.*) After deducting 8¾ per cent. from a certain sum and then 6¼ per cent. from the remainder, there is still left £310 5s. 0d. What was the original sum? Ans. £363 12s. 8$\frac{8}{11}$d.

18. (*Men.*) The circumference of the base of an upright cone being 44 feet, and the slant height 10 feet, find the area of the convex surface. Ans. 220 sq. ft.

(*Women.*) Cut out in lined paper and make up the upper par of a boy's shirt, and one sleeve (half-size).

19. (*Men.*) Find the total surface of a cylinder whose radius is 2 inches, and whose height is 16 inches. Ans. $\frac{1}{2}$ sq. ft.

(*Women.*) (*a*) Name *six* dishes which may be made from a neck of mutton, describing fully the way of preparing *one* of these dishes.
(*b*) What is the best way of peeling potatoes?

20. (*Men.*) Prove Euclid VI. 1.

Triangles and parallelograms which have equal altitudes are to one another as their bases.

(*Women.*) (*a*) Mention some of the ways in which English housewives are often unthrifty.

(*b*) Which are the most economical ways of cooking meat? Give reasons.

21. (*Men.*) Prove Euclid VI. A.

If in a triangle ABC, the bisectors of the interior and exterior angles at A meet BC in D, E respectively, prove that BC is divided harmonically in D and E.

(*Women.*) If the ratio of threepenny to fourpenny pieces in a given sum was changed from 3 : 7 to 7 : 3 the sum would be diminished by £20. What was this sum? Ans. £185.

Third Week.

(*Men.*)

1 to 4. As for First Year, Men.

5. What parts do Polonius, Laertes, and Osric play in the drama? Illustrate by quotations.

6. Give the derivation and meaning of *censure, clepe, cerements, unanealed, lazar-like, gyves, fantasy, conceit, unction, occulted.*

7 to 10. As for First Year, Men.

(*Women.*)

1. Write out the story of Coriolanus as told by Shakespeare.

2. In what sense, differing from their modern usage, does Shakespeare employ the following words?—*Virtue, censure, sensible, humours, complexion, affect, temperance, fond, particular, judicious.*

3. Give a brief summary of Volumnia's pleading with her son for Rome.

4. Which appear to you to be the finest portions of the play? How do they illustrate the genius of Shakespeare?

5. Write out the *dramatis personæ* in what you consider to be the order of their importance.

6. What do you know of *Ancus Marcus, Hecuba, Ulysses, Olympus, Antium,* and '*The rock Tarpeian*'?

7. Write a brief Life of Spenser.

8. What do you know of '*The Shepherd's Calendar*'?

9. Under what disguises are Elizabeth and Mary Queen of Scots introduced into the 'Faery Queen'?

CORRESPONDENCE.

We shall be pleased to reply briefly through these columns to any Subscriber *seeking examinational information or advice, and* Enclosing the Necessary Coupon.

This privilege does not, of course, extend to furnishing the solutions and answers of problems. All such communications should be addressed to 'The Query Editor.'

Replies demanding urgency will be promptly forwarded per post on the receipt of a stamped and addressed envelope, Accompanied by the requisite Coupon.

A post will be saved by writing direct to Dr. George Beach, M.A., (Examination Editor of 'Practical Teacher') Stanley Mount, Macclesfield.

J. R. N. (Milngavie).—We are much obliged for your kind correction.

G. M. E. (Cavendish Square).—(1) Songs not yet published in book form; (2) We will try to find room in next issue.

W. G. (Congleton).—French Author not yet known.

J. W. (Saxey).—Calculation involves elementary spherical trigonometry. Besides, the earth is not a perfect sphere. Next month it shall be dealt with.

C. T. N. (Winchcombe).—(1) You must wait till '95; (2) You can substitute Science for Mathematics.

C. T. (Mansfield).—Your 1893 Science will not count.

URIEL (York), B. A. H. (Ravensthorpe), R. S. R. (Devonport).—See article.

G.C.W. (Redbourn).—Messrs. Macmillan's edition.

J.S. (Congleton).—About July 1895.

A.W. (Nantyglo).—(1) See Code, (2) See August issue, (3) Civil service style.

R.H.S. (Esh Winning).—Full information was given a few numbers ago.

A.A. (Horncastle).—Physical Exercises will probably be compulsory after issue of New Code.

ANSWERED PER ORDINARY LETTER.—A.M. (Hulme); J.H. (Pensnett); W.K. (Chelsea); W.H.C. (West Cowes); F.W.D. (Beccles); A.G. (Dronfield); W.J.G. (Marsden); F.M. (Holyhead) Two Letters; J.W. (Peny Graig); H.S. (Chadderton); P.J.B. (Hanley); J.W. (Bingley); R.J.G. (Halesworth); A.L.M. (Topsham); M.B. (Orton Waterville); A.P.C. (Ellastone); H.W.B. (Alnwick); W.A.W. (Harriseahead); A.R. (Coatbridge); W.R.W. (Torquay); T.W.A. (Nantwich); G.R.B. (Hurdsfield); G.N. (Saltley); W.H. (Crewe); J.H. (Oswaldtwistle); C.P.J. (Clitheroe); W.B.D. (Durham); R.H. (Dover); S.L.J. (Brighton); H.C. (Wheelton); J.P. (Market Drayton); W.W. (Macclesfield; E.A. (Old Goole); H.W.B. (Eglingham); E.J.G. (Durham); W.A.O. (Tredegar); A.M. (Hulme).

EXAMINATION ADDENDA.

Pupil Teachers.—In future the Department will publish once a year, in pamphlet form, the Pupil Teacher questions set at the April and October Examination. The October '93 and April '94 book may be obtained now from or through Eyre & Spottiswoode, price 6d.

Scholarship Candidates.—(*a*) Very shortly the Department will issue a Queen's Scholarship Syllabus, just as at present it puts forth a Certificate Syllabus. This will be obtainable from the Department post free, and will supply a much needed want, especially in the case of such subjects as Domestic Economy. (*b*) This year, in consequence of the proposed change in the Training College Year, there will be a second Scholarship Examination, beginning on the 19th December, as well as the July one.

Certificate Examination.—We must most cordially thank our numerous readers for their communications respecting success at the last Certificate Examination. Appreciation is pleasant. Here is a specimen :—'Result of Certificate Examination just to hand. I am informed that I have been placed in the First Division, having also passed with credit in Mathematics. I should like to thank you for your valuable aid through the "PRACTICAL TEACHER." *I had no other coaching whatever, and I owe my success entirely to the help given in your Certificate Articles.*'—G.W.P. (Gloster). Let us reciprocate. We are sure that G.W.P. and others must have exercised much industry, foresight, and self-denial, and to them we predict the rewards such qualities invariably earn.

ANSWERS TO PUPIL TEACHER QUESTIONS.

ALGEBRA.—THIRD YEAR.

1. $m = 7$.
2. $x^{4m} + x^{3m}y^m - x^my^{3m} - y^{4m}$.
3. 1.
4. (*a*) A Guinea = Sum received.
   (*b*) $x(x+1)+1 = (x+1)^2$.

MENSURATION.

1. $150\sqrt{14}$.
2. 240 sq. ins.

ARITHMETIC.—FIRST YEAR.

Boys.	*Girls.*
1. (*a*) $6\frac{23}{40}$.	1. £90.
(*b*) £235 15s. 7½d.	2. £5 10s. 3d., £14 15s. 9d., £33 13s. 7d., £6 4s. 0d. Total, £60 3s. 7d.
2. 1.	3. 19.
3. ·872.	4. 1,792½ tons.
4. (*a*) Book Work, (*b*) ·625, ·744, ·4375, ·875, ·81.	

SECOND YEAR.

Boys.	*Girls.*
1. £225 17s. 10d. nearly.	1. As in First Year, Boys.
2. 8 per cent.	2. 4 Guineas, 2 Guineas, 1 Guinea.
3. £3 8s. 3d.	3. 13s. 10⅔d.
4. 3s. 4d.	4. As in First Year, Boys.

THIRD YEAR.

Boys.	*Girls.*
1. (*a*) Book Work.	1. (*a*) Book Work.
(*b*) £15.	(*b*) $\frac{217}{221}$, £1 2s. 7½d.
2. 1071.	2. £540 1s. 8d.
3. 50 per cent.	3. 2½d.
4. £2,250 0s. 0d.	4. Book Work.

OUR PUBLISHERS AND THEIR REPRESENTATIVES.

No. 1.—MESSRS. BLACKIE & SON (London and Glasgow).

THE firm of Messrs. Blackie & Son dates back to a respectable antiquity. It was in 1809—a year marked in literary annals by the establishment of the 'Quarterly Review'—that John Blackie, a young Glasgow man of 27, laid the modest foundation upon which the present house has reared itself. He was assisted by two friends, William Somerville and Archibald Fullarton, and for rather more than twenty years the firm was known as Blackie, Fullarton & Co.

Neither books nor bookmen were so numerous as now, nor, if they had been, were the means of circulation many and good. John Blackie began, therefore, by sending his books round among the people, gradually widening the circle until the works were known from John o'Groat's to Land's End. From the first, it was his aim to put in circulation only good books, an aim that was later concentrated in the motto of the firm, *Lucem libris disseminamus.* From a very early period, too, books of a distinctively educational character formed part of his output. The business succeeded so well that at intervals it was found necessary to take larger premises. In 1831 a reconstitution of the firm took place on the retirement of Mr. Fullarton. John Blackie, junior, the eldest son of the founder of the business, became his father's sole partner. About thirty years later John Blackie, senior, retired, leaving the business in the hands of his three sons, the John already mentioned, Walter Graham Blackie, and Robert Blackie.

Both the senior partners died within a few months of each other in 1873 and 1874, John Blackie, senior having attained the patriarchal age of 92 years. The two brothers, who were thus left at the head of affairs, a few years later assumed as partner John Alexander Blackie, the elder son of W. G. Blackie, and later still James Robertson Blackie and Walter Wilfrid Blackie, sons of Robert and W. G. Blackie respectively, joined the firm. Four years ago the firm was formed into a private limited company, but its personality remained the same.

Before this slight sketch of the personal history of the firm is concluded, it should be mentioned that the family has always been in close touch with public affairs. Throughout his long life, John Blackie, senior, entered with zest into every movement for the welfare of the people—religious, educational, and social. He was an active and liberal member of the society founded in Glasgow, about 1835, for the purpose of erecting forty additional parish churches in the rapidly growing city, and he had an important share in the formation and establishment of the Glasgow Academy, which has won a foremost place in secondary education. The second John Blackie followed worthily in his father's steps. As a councillor and baillie of Glasgow, he promoted the building of model lodging-houses for the poorer classes, and during his three years' tenure of the honourable office of Lord Provost, he was in great part instrumental in devising and securing the

passage of the City of Glasgow Improvement Bill through Parliament, an act by means of which the

W. G. BLACKIE, Ph.D., LL.D.

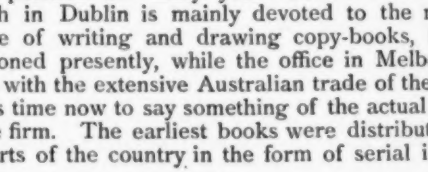
city has been so much improved both in regard to its sanitary condition and its general aspect.

The present Chairman of the Company is Dr. W. G. Blackie, who is an LL.D. of Glasgow University, Principal of St. Mungo's College, a member of the Scottish Universities Commission, and was formerly Lord Dean of Guild. To Dr. Blackie is due the initiation and publication of the well-known 'Imperial Gazetteer,' which owes much to his extensive geographical knowledge and linguistic accomplishments. Mr. Robert Blackie, the second partner, has made art his special province; he has travelled widely, and has utilised his powers of observation with great benefit to the artistic excellence of the firm's productions. An experienced art critic, he has not unfrequently been able by his suggestions to aid artists in perfecting their work. He has acted for many years on the committee of management of the Glasgow School of Art, and took an active part in the formation of the Art Gallery which was such an attractive feature of the Glasgow International Exhibition of 1888.

It has already been indicated that the head-quarters of the firm are in Glasgow. From that centre extend ramifications into all parts of the world. The premises at Glasgow include a large printing and binding establishment at Villafield, near the Cathedral. The *nucleus* of this was purchased, about 1833, from the Duncans, then the largest printing house in the city, and large extension of premises has at various times been effected. In 1870 the publishing department was removed from North Frederick Street to the large and handsome building adjoining the works at present occupied by the company. Every branch connected with publishing, printing, and book-binding is there carried on, and a walk through the building is most interesting. Entering from Stanhope Street, the visitor finds himself at once in the publishing and counting-house department, in which he sees shelf after shelf stocked with the numerous publications of the firm, and a large staff of clerks and other officials occupied with the work of their several departments. A flight of stairs leads to the next floor, upon which are the private rooms of the members of the firm; the library, a large room filled with an immense number of books and periodicals, to which standard works of reference are constantly being added; the Art Room, where the multifarious details connected with book illustrations and designs for covers are attended to. A corridor leads to the binding department, to which three large floors are devoted. From this department the visitor proceeds to the printing works, which are subdivided into well-lighted composing-rooms, readers' rooms, and the machine room, where machines of every size and make are at work, and the stereo and electro-type department, where plates are made from the types. In other parts of the building are the lithographic and copper-plate departments. Practically the whole of the works issued by the firm are manufactured here, and altogether over 500 persons are engaged in performing the various operations involved in their production.

In addition to their Glasgow house, the firm has branches in London, Dublin, and Melbourne. The London offices are situated at 49 and 50, Old Bailey, and form the centre from which the entire English trade is carried on. They are under the management of Mr. James Martin, whose father held the same position for many years before him. The branch in Dublin is mainly devoted to the manufacture of writing and drawing copy-books, to be mentioned presently, while the office in Melbourne copes with the extensive Australian trade of the firm.

It is time now to say something of the actual work of the firm. The earliest books were distributed in all parts of the country in the form of serial issues.



MR. ROBERT BLACKIE.

Among these were the famous 'Imperial Family Bible,' which had a very extensive sale, and copies

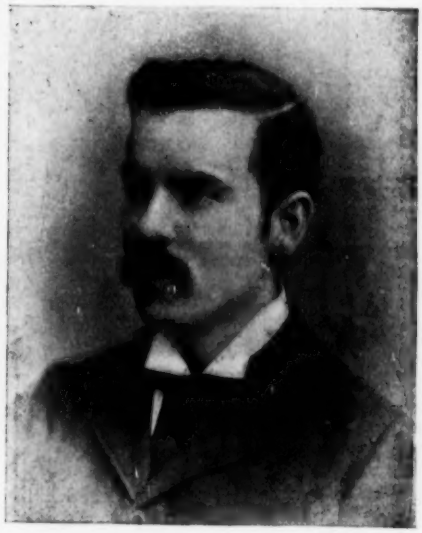
MR. J. ALEXANDER BLACKIE.

of which have been met with so far from home as the Canadian backwoods; several standard commentaries, such as Matthew Henry's; Ogilvie's 'Imperial English Dictionary,' which, as revised by Dr. Annandale, remains in high repute; the 'Imperial Gazetteer'; the 'Comprehensive History of England'; the 'Works of the Ettrick Shepherd'; the 'Popular Encyclopedia'; the 'Casket of Literature.' Some of the more recent works in general literature are the 'Modern Cyclopedia,' the 'Henry Irving Shakespeare,' and a finely illustrated 'History of the Scottish People,' as well as many works on technical and scientific subjects, such as 'The Steam Engine,' 'The Carpenter and Joiner's Assistant,' 'Villa and Cottage Architecture,' 'The Household Physician,' 'The Practical Decorator,' &c.

MR. J. ROBERTSON BLACKIE.

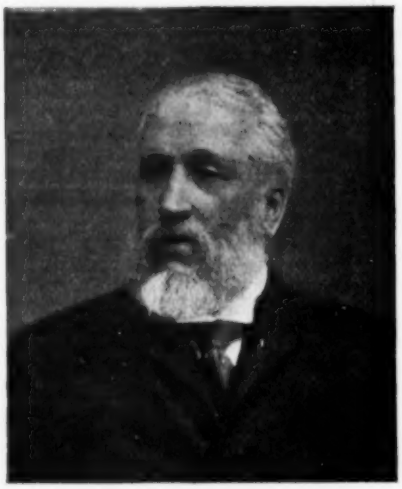
It is chiefly, however, as publishers of educational and juvenile literature that Messrs. Blackie & Son have a special interest for the scholastic world. Only fifteen or sixteen years have elapsed since this branch of the work was entered upon; but it has developed so rapidly and enormously that it now takes a prominent place in the operations of the firm. It was begun when Messrs. Blackie & Son became the publishers of the writing and drawing books, known under the name of Vere Foster. These were acquired with the full intention of embarking on general educational publishing, and the first experiment in this general work was made by the issue of 'The Comprehensive Readers.' These were compiled by a committee of Birmingham men, and they at once leapt into favour; even now, when their rivals are so many, they are still extensively used. This first success was followed by many others. General reading books, such as 'The Century Series' and 'Stories for the Schoolroom, and Readers in Geography, History and Science, have been produced from time to time, while in nearly every branch of education useful and successful books have appeared.

The causes of this success are of course various. Apart from the intrinsic excellence of the subject-matter, Messrs. Blackie & Son's books have been distinguished from the beginning by their material qualities. The typography, the illustrations, the binding have always been directly supervised by the members of the firm, and this is sufficient to account for the general tastefulness which characterises all the books, as well the penny primer as the five-guinea dictionary. Another factor in their success must be sought in the way in which the books have been assiduously brought to the personal notice of teachers. Since the time when Messrs. Blackie's first educational traveller, Mr. James Nichol, carried the publications of the firm into all parts of the country, the tradition has been consistently maintained, and the travellers have lost no time in showing the new books immediately after publication. Mr. Nichol was the first traveller who attended a teachers' meeting, and it is curious to compare the publishers' exhibition of twenty years ago with the exhibition of to-day. At the conference of the N.U.E.T., held in 1873 at Bristol, the whole exhibition, in Mr. Nichol's words, "occupied a single chair in the vestibule, which also supported the one exhibitor." Now-a-



MR. WALTER W. BLACKIE, B.Sc.

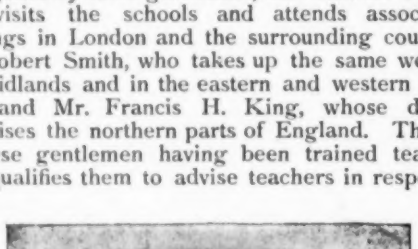
days it is a matter of extreme difficulty to provide for the wants of publishers in this respect, as may



MR. JAMES MARTIN.

be judged from the importance and extent of the educational exhibits at this year's Oxford Conference.

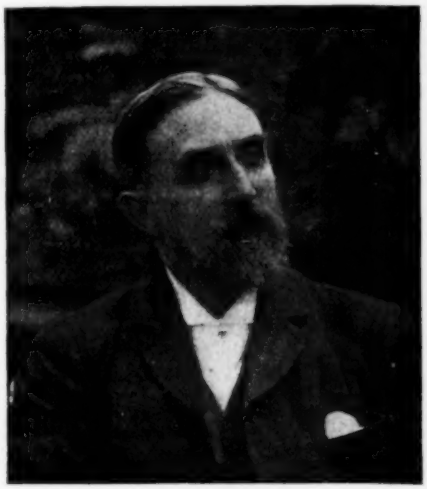
At present Messrs. Blackie & Son are represented in England by three gentlemen, Mr. Charles Castell, who visits the schools and attends association meetings in London and the surrounding counties; Mr. Robert Smith, who takes up the same work in the Midlands and in the eastern and western counties; and Mr. Francis H. King, whose district comprises the northern parts of England. The fact of these gentlemen having been trained teachers well qualifies them to advise teachers in respect of



MR. ROBERT SMITH.

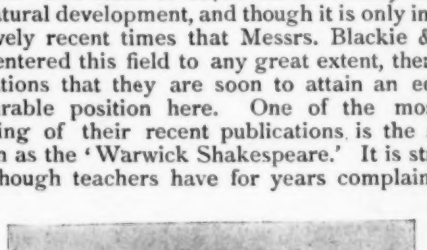
the Code, and the intricacies of elementary education generally.

The first educational efforts of the firm were directed to the supply of books for the elementary



MR. CHARLES CASTELL.

schools, at a time when, through Mr. Forster's Act, elementary education had begun to receive its due recognition. But it was only natural that the publications should not be limited to books for primary schools. The issue of books for secondary schools is a natural development, and though it is only in comparitively recent times that Messrs. Blackie & Son have entered this field to any great extent, there are indications that they are soon to attain an equally honourable position here. One of the most interesting of their recent publications is the series known as the 'Warwick Shakespeare.' It is strange that though teachers have for years complained of



MR. FRANCIS H. KING.

the standard school editions of the dramatist as being too philological, no serious attempt was made by the

publishers to provide an edition in which the literary aspect was made specially prominent until Messrs. Blackie & Son made the experiment. Among other educational books it is noteworthy that Deschanel's 'Natural Philosophy,' by Professor Everett, has reached its thirteenth edition. This standard work has had a remarkable sale for a scientific book, and it is curious that it has been far more successful in this country than in France, where it was originally produced.

In the department of reward books, Messrs. Blackie & Son have very rapidly come to the front. Messrs. Blackie's first adviser in this branch was Mr. Thomas Archer, whose death last year cast a gloom over a wide literary circle. It was he who introduced to the firm Mr. G. A. Henty, the famous war correspondent and writer for boys, whose works are increasingly popular and more eagerly looked for by the boys every year. Among the other authors, whose names figure on Messrs. Blackie's list, are George MacDonald, Manville Fenn, Baring Gould, Professor A. J. Church, Sarah Doudney, Robert Leighton, Frankfort Moore, Rosa Mulholland, and Beatrice Harraden.

While these reward books have been distinguished from the beginning by their sterling literary qualities, they have been particularly remarkable for the excellence of their illustrations and general get-up. It is not too much to say that Messrs. Blackie & Son set the fashion in acting on the principle that nothing is too good for the children. The services of artists in black and white of the highest rank have been enlisted, among whom may be named W. Hatherell, R. I., Solomon J. Solomon, Frank Brangwyn, W. H. Overend, R. Caton Woodville, A. Forestier, Gordon Browne, and W. H. Margetson.

There remains for brief mention the writing-book and drawing-book departments of the business. The former is identified with the name of Vere Foster. Mr. Vere Foster, son of Sir Augustus Foster (sometime British Ambassador) and kinsman of Lord Palmerston, was educated at Eton and Christchurch. He began his work in teaching writing out of a pure spirit of philanthropy. His system of writing was devised in accordance with a suggestion of Lord Palmerston, and though originally intended as an indirect means of improving the condition of the Irish, when Messrs. Blackie & Son took up the writing as a branch of their business, it was soon found that the merits of the system were carrying it into all parts of the world. The manufacture of copy-books and the drawing-books bearing Mr. Vere Foster's name, is carried on by the Company, as has been said, in Dublin. There a large number of printing, folding, and cutting machines are kept constantly employed. Last year the number of books turned out at the works was larger than ever. These copy-books, which have been adopted by numerous School Boards, and by H.M.'s Government, for the Army and Navy Schools, are in extensive use, not only in the United Kingdom, but also in India and the various Colonies. The Annual Writing and Drawing Competition, inaugurated by Mr. Foster, attracts competitors in all quarters of the globe, and it is an interesting fact that one of the recent prize-winners was a little Maori girl in New Zealand.

WELL-KNOWN TEACHERS AT WORK.

XXVIII.—MR. ERNEST GRAY.

President of the N.U.T. Head Master of St. Gabriel's Schools, Pimlico, S.W.

The trend of thought of all good Unionists and true is at this present in the direction of Oxford, at whose Conference many of them will assist, and the central figure of which will be the President: much legitimate curiosity will fill the minds of the faithful as to what manner of man their Chief may be. To satisfy this laudable desire to know was our pretext for a visit to Pimlico a few days ago. Mr. Gray gave us a courteous reception, and with the *savoir faire* of a man who knows what interviewing means, expressed his willingness to answer any questions we might choose to prefer. Of this permission we took full advantage ere our departure, and if our readers are as interested as we were, our visit will not have been in vain. We found the Master in a room which for refinement—not to say elegance—and comfort will compare favourably with any of the class-rooms to be found in more pretentious buildings. Not a map was to be seen on the walls, neither were any charts displayed thereupon, and this applies throughout the whole of the school. Artistic pictures, comprising paintings in both oil and water colours, and good engravings, take their place; a good display of statuary is also visible in the Head Master's room, which contains, in addition, the library of 1,000 volumes, and a museum replete with all the objects which may be *useful in illustration of the reading lessons*, for which purpose they are regularly used throughout the school, the children being wisely permitted to get their ideas first hand from the actual things. And very curious some of the things were: here, slave fetters from Zanzibar and a water-bottle from the Nile; there, an assegai from South Africa; on this side a goodly collection of moths, on the other a set of minerals constituting the scale of hardness, to say nothing of the collection of fossils and minerals and natural history specimens, to which Mr. Gray has added many curios picked up in the course of his numerous Continental wanderings. A good magic lantern, and a piano, also met our eye upon entering, and we were prepared to learn that the former is of eminent service in teaching geography. One of the three class-rooms can readily be turned into a dark room, and when we learn that Mr. Gray subscribes to a Lantern Society, owning some 7,000 slides, we can believe that adjournment to the aforesaid room is not only frequent, but also productive of excellent results in the acquisition of geographical, historical, and scriptural knowledge.

The boys' department comprises a large room, divisible into three by curtains, and the three class-rooms above referred to. The staff consists entirely of adult teachers, pupil-teachers being as rigidly excluded from the school as maps are from the walls. The prospects of a teacher are nowadays so precarious and poor that Mr. Gray looks upon the introduction of a boy into the teaching profession as nothing short of cruelty, both to him and to his competitors, hence the absence of pupil-teachers from St. Gabriel's.

Although the children are from families differing very much in social position, their personal appearance is uniformly neat. This is brought about by tact and a healthy public opinion, which regards an untidy boy much in the same way as the bees feel towards an intruder in their hives. 'We cannot prevent a boy from coming to school with an unsightly muffler round his neck, but we can, and do, prevent him from wearing it in school, and he soon has the sense to see that it is best to replace the scarf by a collar.' The appearance of the boys certainly left nothing to desire in this respect.

One afternoon in each week has a unique reading lesson; the boys are permitted, and encouraged, to read from their library books, and very popular, and withal truly educative, is this practice, inculcating at one and the same time a love for reading and the habit of self-teaching. Another special feature is the home-work, which consists mainly of illuminated lettering and sketches in illustration of some portion of literature which has previously been learnt. It was abundantly evident that an effort was made in each case to get to the meaning of the words, which indeed is absolutely necessary if anything like an adequate illustration of the passage is to be given. The artistic side of the instruction is undoubtedly strong, nor is a reason for this wanting. Hard by the school is Doulton's Pottery Works, whither many of the boys gravitate upon leaving school. It needs no argument to prove that the nurture which their talent for design and colouring has received materially assists them in obtaining a foothold in this home of English art pottery, and wise is the policy which puts the boys in the way of making such a good start in the battle of life. Still keeping to matters artistic, we learn that music is specially attended to, the Old Notation being adhered to: no less than five choirs are practically officered from this school, which speaks volumes for the musical efficiency thereof. Without saying it goes that the full grant is earned in this as in all other subjects.

Mr. Gray does not by any means magnify the importance of reports; indeed, he directed us to make no mention of documents, which may be so misleading; still, we are constrained to add that he has every reason to be more than satisfied with those which have fallen to his lot. In ensuring a good attendance, the President trusts to his own devices, and is not disposed to depend upon the School Board visitor. Every child who has been absent not at all during the school year receives a medal, bearing on one side the following superscription:—

ST. GABRIEL AND ST. SAVIOUR'S SCHOOL,

AWARD FOR

REGULARITY.

LONDON.

On the reverse side is to be found the fleur-de-lys, a correct copy of which Mr. Gray himself procured from Fontainebleau; the fleur-de-lys is the emblem of St. Gabriel, and it is worn by the boys on their caps. A beautiful reproduction of this appears on the banner which is placed in the room which shows the best attendance in any particular week. One boy, named Plaice, owned to the possession of no less than seven medals; his brother is the proud possessor of six, and a goodly number of other boys were pointed out to us whose attendance was equally satisfactory. Free education—for the school is free throughout—has here, as elsewhere, had the effect of lowering the percentage of attendance somewhat, a few bad cases of irregularity being the cause of this retrogression.

For his managers Mr. Gray has words of rare praise. Meetings are regularly held, at which a quorum of managers is always present. All classes of subscribers are represented on the managing body, the ladies being especially active in promoting the welfare of the school. Rarely does a year pass without improvement in the building or apparatus being effected. The subscriptions are well maintained, so that although the school exceeds the 17s. 6d. limit by £150, no money is ever returned to the Department, which speaks well for the subscription list. It is pleasant to find a voluntary school managed so enthusiastically and so intelligently, and we join our host in his fervent *O si sic omnes*. We should hear of none of the abuses and outrages which are the outcome of one-man management if all voluntary schools were in such good hands as is St. Gabriel's. Many evidences of this gratifying fact meet us on all sides, and it is easy to see that the school does not lack friends, for the beautifying of the walls is due in great measure to the generosity of these latter in presenting pictures and engravings for the ornamentation of the school.

Grammar finds no place in the curriculum of St. Gabriel's, elementary science being taken in its stead. Notwithstanding this fact, the school is particularly strong in literature, and the composition is specially good, as we ourselves can aver from what we saw. The specific subjects taken are Physiology and Botany, and special effort is made to make this part of the work as practical as possible, botanising expeditions being made periodically for practical work in the latter of these two subjects, whilst actual specimens of skulls, eyes, etc., are handled and dissected in order to make the physiology something more than a mere knowledge of names.

St. Gabriel's is one of the two voluntary schools that have entered into competition with London Board Schools for the Drill Challenge Banner. On one occasion Mr. Gray's competitors gained second place; but the drill taught here, which is nothing more nor less than that practised by the Guards, does not find favour with the powers that be at the Victoria Embankment, wherefore the school is out of the running on this account. Judging from the photo of the Drill Contingent, it would require an exceptionally fine set of lads to beat St. Gabriel's in smartness.

With his staff Mr. Gray deals in the same spirit of confidence as is exhibited in his demeanour towards his boys. Each master is required to record in a class-book the work that he has been able to get through in any particular week, and upon this work the examination is founded. Be it noted that the Head Master invariably takes a class, howbeit his 370 scholars would form ample reason for abstention from actual class teaching. We cordially agree with Mr. Gray that this practice is admirable, if not absolutely essential. What struck us in the teaching of the President was the quiet and effective way in which he handled his class. Bustle there was none, but quiet,

steady, continuous work was evidently the order of the day at St. Gabriel's. Mr. Gray was formerly a pupil-teacher at the Central Schools, Marylebone, whence he passed in 1877 to St. John's College, Battersea; leaving there he became Head Master of St. George's School, Hanover Square, W., which post he resigned twelve years ago in order to take up the mastership of his present school. He joined the N.U.T. immediately upon leaving college. His first appearance at the Executive was as member for the West Yorks District Union in 1886, and he became an elected member in the following year. He has been Vice-Chairman of the Law Committee, Chairman of the Parliamentary Committee, and Chairman of the Parliamentary Election Committee. It is in connection with House of Commons work that Mr. Gray has done such yeoman service to the cause of education. He is past master in the art of lobbying, and might write an invaluable treatise upon the noble art of buttonholing M.P.'s. Let no one underestimate the importance of this kind of work, for it is mainly by giving information and dissipating misconceptions which always arise in the heat of a debate that the average M.P. can be made to give an intelligent vote on an educational question. The ignorance of members respecting educational questions is stupendous; no one deplores this more than the members themselves, as a vote in the right direction with regard to education is always intensely popular with any constituency. But ignorance prevents the popular vote from being given. 'Why don't you come here yourself?' said an M.P. to Mr. Gray on one occasion; 'Hart-Dyke is not strong and Mundella is a humbug, and we don't know which to support.' Everybody knows now that our President intends to 'go there' himself, and he has every reason to believe that North-West Ham will send him. Since his adoption as the Conservative candidate for this constituency a year ago most active has been his campaign. He has visited the borough 156 times, he has delivered 94 speeches, and attended 89 public meetings in other places. Add to this his meetings in connection with the N.U.T., and some appreciation of Mr. Gray's devotion may dawn upon us. On 36 separate occasions the candidate was unable to get home at all, and when on other occasions he did get there, 12·45 a.m. was his hour of arrival. What Mrs. Gray has to say to this did not transpire; but it did transpire that Mr. Gray's devotion to our interests nearly 'slit the thin-spun thread of life.' Let it be our privilege to see that the 'blind fury with the abhorred shears' never does remove the praise which is the due of such self-denying efforts as those of our President, for, be it remarked, 'Fame (and not bawbees) is the spur that the clear spirit doth raise to scorn delights and live laborious days.' To the above multifarious duties we may add that Mr. Gray is a Member of the School Gradation Committee, which may be expected to do good work in bringing about an *approchement* between elementary and secondary schools, a member of the Association of Higher Grade Schoolmasters, and an honorary member of half-a-dozen political associations outside West Ham, to say nothing of his lobbying, and of the duties that are inseparable from his position as a Director of the *Schoolmaster*. Truly Mr. Gray is a notable pluralist and a veritable gourmand for work; still he claims, and justly so, we firmly believe, that his school duties are as zealously and as vigorously performed as in the case of the man who is content to take no extra scholastic burdens upon himself; and he furthermore avers that this is equally true of his colleagues at Russell Square, which again we most cordially accept as a bold statement of matter of fact. Mr. Gray is responsible for the work of Standards VI. and VII. Some wiseacres, we venture to remind our President, scoff at the idea of one or two Members of Parliament—and these teachers—being able to influence the 600 odd members who constitute the House of Commons. 'Let them go through a course of lobbying,' responded Mr. Gray, 'and then let them observe how the House will stop its chattering and listen with wrapt attention to a specialist, as in the case of John Burns, and their incredulity will ooze out of their fingers' ends. M.P.'s are mostly public school men who have to be crammed up night after night in the lobbies with respect to the veriest simples of elementary school practice. They do not even understand the difference between average and percentage of attendance, and are delivered bound into the hands of the permanent

Faithfully yours
Ernest Gray

official. Hence the triumphs of the Education Department and of the Science and Art Department over common sense. The presence of a single teacher in the House would nip much of this jugglery in the bud. Why, even now, political men with whom I am thrown into contact habitually, say with respect to any educational nut which has to be cracked, "Ask Gray, he is the man who understands that." Most firmly do we believe in the absolute truth of our host's contentions, and we earnestly hope that the active support of every teacher in North-West Ham will be ungrudgingly yielded. Most of them have already done this. Some will abstain from voting against their fellow-teachers: we call upon them to go further, and to vote for him, putting politics on one side in favour of the more pressing demand for professional representation. To us it seems that the duty of each and every teacher is to vote straight for Gray, let them belong to what political camp they may. Mr. Gray opines that little need be said as to his professional views; they are already well known from his public utterance.

He favours a fair field and no favour as to the Inspectorate; and whilst acknowledging the common sense shown in the appointment of such men as Northrop and Hodges, he deprecates the intrusion of University men as such, as in the case of Roberts. Eligible teachers are not wanting, and these should have their just claims allowed.

Regarding Superannuation, the President, whilst adopting a position of benevolent neutrality towards the London Board Scheme, favours a general system which shall include all teachers.

Mr. Gray does not support the extension of District Unions to metropolitan or large urban associations. He thinks they can exert more influence in their individual capacity. To this doctrine we are unable to subscribe, for reasons which cannot well be recorded here. Suffice it to say that we agreed to differ with our host respecting this question.

Reverting for a moment to the management of his school, which Mr. Gray so warmly commends, the following inscription on a mural tablet, which occupies a conspicuous position in the room with the bright aspect of which we were so pleased, will show that Mr. Gray's appreciation rests upon a solid and intelligible basis:—

'To the glory of God, and the dear memory of Agnes Sitwell Ellison, this library and museum were founded for the children of these schools by J. H. J. Ellison' (husband, and Rector of St. Gabriel's).

Already have we intimated the extreme probability of the addition of M.P. to the name and description of St. Gabriel's Head Master in the near future. It is with extreme pleasure that we are able to publish the certain addition of M.A. within the next few days; for Oxford, to its lasting credit, has determined to honour the N.U.T. by bestowing (*causa honoris*) upon its President the degree of M.A. Who knows whether Mr. Acland may not be emboldened by this to raise a teacher to the Inspectorate, and who knows whether this teacher may not be the newly-fledged M.A. himself. Truly we are progressing in public esteem.

Of the inadequacy of this sketch we have a painful and lively consciousness; but our excuse must be that a whole volume would be required to give a just account of Mr. Gray's many-sided activity. Of this we are convinced, that as schoolmaster, and as schoolmaster's champion, both at Russell Square and ere long, we trust, at St. Stephen's, Mr. Gray will always be found *secundus nulli*.

LONDON MATRICULATION.

PREPARATION CLASS FOR JANUARY, 1895.

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LATIN.

WE are setting this month a test paper on Latin grammar and sentences. For regulations as to correcting answers, see correspondence at end.

Latin Course for April.

1. Vergil Aeneid III. 293–440. Page's edition (Macmillan.)
2. Grammar: (α) Postgate's Latin Primer (Cassell), §§ 43–53; §§ 131–141; §§ 284–286; §§ 302–312; or (β) Allen's Latin Grammar (Clarendon Press), §§ 29–37; §§ 101, 102, 108–211, 114–119; §§ 161–167; §§ 235 and 237; §§ 240–254. Revision of the declensions. In last month's issue Allen §§ 161–163 was inadvertently omitted.
3. Translation at Sight: A couple of pieces a week.
4. Bayfield: Exercises 5–24, 7–9 in each; Exercises 24–80, the fifth one in each.

Notes on Latin Work.

Supplementary Notes to Page.

296. *potitum* governs the ablative, sometimes the genitive.

299. Students should distinguish *compellare*, 'to address,' and *compellere*, 'to drive together.'

300. *portu*, 'from the port,' abl. of 'motion from,' without a preposition.

316. *ne dubita*, 'do not doubt,' would in prose be *ne dubitaveris*.

319. *Pyrrhin'* = *Pyrrhine*. Students should note the differences between *num*, *ne*, and *nonne*, in asking questions.

320. *demissa voce*, 'with lowered voice,' ablative absolute.

333. *morte Neoptolemi*, 'on the death of Neoptolemos.' *morte* is either abl. of time, or abl. of cause.

338. *nostris—adpulit oris*, 'has driven to our shores'; *oris*, poetical use of dative, instead of *ad* with the acc.

339. *Quid puer*, 'what of the boy Ascanius?' Note the omission of the verb.

339. *vescitur aura*. Note that *potior*, *fruor*, *vescor*, *nitor*, and *fungor*, are followed by the ablative.

352. *necnon*, lit. 'nor not,' = 'and also.'

354. *aulai medio*, 'in the middle of the court,' would in prose be *media aula*, just like *summus mons*, 'the top of the mountain.' Note the archaic genitive.

357. *carbasus*. Note this is a fem. noun of the second declension, and learn the other fem. nouns as well.

358. *his dictis*, 'with these words,' abl. of attendant circumstances.

359. *divum*, gen. plural.

360. *Clario*, *i.e.*, 'Apollo,' who had a temple at Claros.

361. *volucrum*. Students should note the parisyllabic words with stems in *-i*, that have gen. plural in *-um*; *e.g.*, *canis*, *panis*, *vates*, *senex*, etc.

363. *suaserunt numine*, 'persuaded me by their divine power.'

364. *petere*. Verbs of persuading, when followed by 'to' and the inf. in English, are followed by *ut* and the subjunct. in Latin. The use of the inf. here is poetical.

375. *maioribus auspiciis*, 'with greater auspices,' abl. of attendant circumstances.

377. *quo* is used to translate 'in order that,' when followed by a comparative. The literal translation is, 'by which with greater safety you may,' etc.

381. *rere*, 2nd sing., pres. indic. of *reor*.

387. *via invia*, an instance of *oxymoron*, or verbal paradox; *longis terris*, abl. after *dividit*, 'separates Italy from our distant lands,' or 'by distant lands.'

392. *solo*, abl. of 'place,' without a preposition.

394. *nec horresce*. Another instance of the poetical use of the imperat. in a prohibition.

403. *quin*. Distinguish this use of *quin* from its use after negative expressions, like *non dubito*, etc.

steterint, fut. perf. indic., which is often translated in English by a present tense. The Latins were much stricter as regards the use of tenses than we are.

405. *velare* is imperative 2nd sing. here.

409. *religione*, 'religious practice'; *maneant* is jussive subjunct.

410. *admoverit*, fut. perf., as *steterint* above; *orae* is dat. of 'motion to.'

415. *ferunt*, 'they say.'

422. *praestat*, 'it is better.'

434. *veris implet*, 'fills with truth.'

440. *finis Italos mittere*, 'thou wilt be sent to the Italian lands.' Note the acc. of 'motion to' without a preposition, which in Ciceronian prose is only permissible in the case of towns and small islands, *domus* and *rus*.

Trinacria relicta, 'after leaving Trinacria,' abl. absolute. Note how to translate the abl. absolute, and also note how to translate '*after*,' followed by a *verbal noun*, into Latin.

Latin Grammar Notes.

Students should be constantly revising the declensions, especially the third with its long array of words with varying stems and puzzling genders. Whatever history may do, Latin grammar, unfortunately, does not repeat itself. In this month's course, we recommend the student to pay great attention to the following points. The numerals are essential, whether cardinal, ordinal, distributive, or adverbial. Note the use of *distributives*—(1) to denote 'so many apiece'; (2) with nouns having no sing., or a different meaning in the sing.; (3) in multiplication, as *bis bina sunt quattuor*. Note the indeclinable numerals, and the use of the ordinals where we use the cardinals, *e.g.* in dates. Note how to express fractions. The uses of *mille* and of *unus* in the plural are important. Distinguish *triceni* (30 apiece) and *treceni* (300 apiece). The declension of the pronouns should be mastered, and the differences between *qui*, *quis*, *quid*, and *quod*, known. In the syntax it is important to remember that a verb that does not govern an acc. is an *intransitive* verb, and can only be used impersonally in the passive; *e.g.*, *mihi persuadetur*, 'I am persuaded.' The principal uses of the acc. are important. The following usages are poetical: (1) the acc. of respect, *latus humeros;* (2) *Greek* acc. after passive verbs, *tempora lauro redimitus;* (3) acc. of '*motion to*,' without a preposition, in the case of places other than names of towns, small islands, *domus* and *rus*. Learn the prepositions which take the acc. The classes of verbs that take two accs. should be known, and also what becomes of the two accs. in the passive; the verbs of asking, that do *not* take two accs., should be known—*e.g.*, *peto*, *postulo*, *quaero*, etc. Note use of acc. to express 'time how long,' and 'distance.' Note *natus quinque annos*, 'five years old'; *abhinc quinque annos*, 'five years ago.' Make up instances of *cognate* and *adverbial* accusatives. Be able to illustrate the following: *ethical* dative, *dative of advantage* or *disadvantage*, *predicative dative*. The *double dative* is the name given to the combination of a predicative dat. and the dat. of the person, as *auxilio est civibus*, 'he is of help to the citizens.' The agent after the gerundive is expressed by the *dative*. Students should avoid using it in other cases. It is permissible to do so in poetry, but poetry and the matriculation sentences are two different things. It is essential to know the classes of verbs that govern the dative, as well as the principal exceptions, like *laedo*, *iubeo*, etc. A certain number of each class should be entered in a note book. Note the differences of meaning when *consulo*, *invideo*, *impero*, *credo*, etc., take the acc. and dat. respectively. Note that *sociis frumentum imperatur*, 'corn is levied on the allies,' is good Latin, because *impero* takes an acc. of what is ordered to be supplied, but *socii imperantur*, 'the allies are ordered,' is bad Latin, and should be *sociis imperatur*. Note the use of the dat. to express 'motion to' is poetical.

Solution of sentences set last month, and additional sentences.

(1) After threatening the citizens with punishment, he left the city of London with his two brothers.

Civibus mortem minatus, ex urbe Londinio cum fratribus suis duobus excessit.

Notes.—(*a*) *minor* takes the acc. of the thing and dat. of person. (*b*) For the use of the perf. part., see (1) (*a*) last month. (*c*) A genitive of definition, like '*of London*,' is in Latin expressed by using a noun in apposition to *urbs*, not by the genitive. (*d*) '*his*' is expressed by *suis*, and not by *eius*, because it refers to the subject of *excessit; eius* would denote someone else's brothers.

(2) Who does not know that I prevented him from making war against that race?

Quis nescit me eum prohibuisse quominus in eam gentem bellum inferret?

Notes.—(*a*) *Quis* is the interrogative pronoun, *qui* the relative pronoun, or interrogative adjective. (*b*) For use of *acc.* and *inf.*, see (2) (*d*) last month. (*c*) For use of *quominus* after a verb of preventing, see (3) (*b*) last month, and for tense see (3) (*c*). (*d*) *bellum inferre* generally used of an offensive war.

(3) We ought to have gone to the camp at Marseilles as soon as possible.

Massiliam ad castra quam celerrime ire debuimus.

Notes.—(*a*) Where we use with a verb of motion one word denoting 'motion to,' and another denoting 'rest in,' as here, 'to the camp *at* Marseilles,' we must translate into Latin as if the English were 'to Marseilles, to the camp.' (*b*) For the omission of preposition with *Massiliam*, see (2) (*g*) last month. (*c*) '*as . . . as possible*,' is translated into Latin by *quam*, and

the superlative of the adverb required. (*d*) For tense of the inf. *ire*, see (4) (*c*) last month. To write *ivisse* would be a serious mistake, as the action of 'going' cannot be antecedent to the duty of doing so.

(4) We had asked him when he stopped at Rome.

Eum quando Romae esset commoratus rogaveramus.

Notes.—(*a*) *When* in a question is translated by *quando*, not by *cum*. (*b*) 'Place where' is expressed in Latin generally by the *abl.* with *in*, except in the names of towns and small islands, *domus*, *rus*, and a few other words. If the town or island is of the first or second declension, and singular, it is put in the genit., otherwise in the abl. This is a remnant of the old locative case. (*c*) This subjunctive is due to the dependent question.

(5) I should have advised you to make it your aim to carry out your plans without delay.

Te monuissem (or *monere debui*) *ut id ageres ut sine mora consilia tua conficeres.*

Notes.—(*a*) If '*should have*' merely denotes a condition, use the plpf. subj., if it denotes duty use *debui* and pres. inf., *not* perf. inf. in accordance with (4) (*c*) last month. (*b*) *id agere* fol. by *ut* is the normal phrase for 'to make it one's aim to,' and the use of the subjunct. here after *moneo* depends on the rule given in (4) (*b*) last month. (*c*) The tense of the two subjunctives depends on (3) (*c*) last month.

(6) After ordering him to put these citizens to death, they advanced to Umbria by forced marches.

Cum ei imperavissent ut hos cives interficeret in Umbriam maximis itineribus contenderunt.

Notes.—(*a*) '*After ordering*' = '*having ordered.*' Now *impero*, 'to order,' has no *perf. act. partic.*, therefore we have to use one of the two substitutes, either (1) *cum* with plpf. subjunct., or (2) the abl. abs. of the perf. pass. part. The latter is inadmissible. *Impero* governs a dat. of the person in the act., and therefore cannot be used personally in the passive. See (1) (*a*) and (5) (*a*) last month. (*b*) For the use of *ut* after *impero*, see (4) (*b*) last month. If *iubeo* were used instead of *impero*, we would have *eum hos cives interficere iussisset*, or *ab eo hos cives interfici iussisset*, to avoid ambiguity. (*c*) As *Umbria* is not a town, the preposition *in* is used, which requires the acc. when expressing motion.

(7) How few there are who are willing to help the needy and unfortunate!

Quotusquisque est qui egentes et miseros iuvare velit.

Notes.—(*a*) Note the phrase *quotusquisque* (which is singular), lit. 'what number in a series (*quotus*) each?' (*b*) The relative *qui*, when its antecedent is an indefinite word or a word referring to a class, requires the subjunctive. This is called the *generic* subjunctive. (*c*) The sequence of tenses decides the tense of the subjunct. The principal verb (*est*) is in a principal tense, hence the tense of the subjunct. must be either pres. or perf.; the present is used to denote pres. fut. or continuous time, the perf. antecedent time to the verb of the principal clause. (*d*) Most verbs of *helping* take the dat., but *iuvo* and *adiuvo* take the acc.; if *subvenio* were used, the dat. *egentibus* and *miseris* would be required.

(8) Do not prevent your son from condemning such a crime as this.

Ne filium tuum prohibueris quominus hoc tale scelus condemnet.

Notes.—(*a*) A direct prohibition is in Latin expressed by *ne* and the perf. subjunctive, or more politely by *noli* and the infinitive. Never use *non* and the imperative, which the beginner is predestined to do. (*b*) The perf. subj. in a prohibition is a primary tense, hence the pres. subjunct. *condemnet* in the dependent clause, because the action of condemning is fut. to that of preventing. See (7) above. (*c*) Beginners will unanimously translate 'as this' by '*quam hoc*'; 'such a . . . as this' must be translated as if it were 'this such . . .' Again, *such*, when it is attached to a noun, must not be translated by *tam*, but by *talis* or *tantus*, according as it refers to *quality* or *quantity*. *Tam* will translate 'such' before an adjective—'*tam bona uxor*,' 'such a good wife.' (*d*) *Crime* is not to be translated by *crimen*, which means a '*charge*' in Ciceronian Latin, but by *scelus* or *facinus*. The similarity in form between some Latin and English words often proves a will o' the wisp to the beginner.

(9) The city would have been captured in a week or more, if the general had been induced to part from the summer camp.

Urbs intra septem vel plures dies capta fuisset, si imperatori persuasum esset ut ex aestivis excederet.

Notes.—(*a*) '*would have*,' when occurring in a principal clause is expressed by the plpf. subjunct. active or pass. (*b*) Time *within which* an event happens is translated either by the abl. without a preposition or by *intra* with the acc.; in the above, *septem vel pluribus diebus* is an alternative rendering. (*c*) The mood of the verb following *si* depends on the mood of the verb in the principal sentence or *apodosis*; if the verb in the principal clause is subjunctive, use the subjunctive after *si*; if the verb in the *apodosis* is in the indic., imperative, or a subjunctive which is equivalent to an imperative—*e.g.*, the *jussive subjunctive*—use the indicative after *si*. This rule is most important, as beginners feel inclined to put the *subjunctive* always after *si*. (*d*) *persuadeo* governs the dat. in the act., hence must be used impersonally in the passive. (*e*) Note that 'to' and inf. is again translated by 'ut' and subjunct. See (4) (*b*) last month, for reason. For the imperf. subjunct. see (3) (*c*) last month. (*f*) *aestiva* (*castra*) = 'summer camp'; *hiberna* (*castra*) = 'winter camp'; *stativa* (*castra*) = 'stationary camp.'

Latin Test Paper.

1. Comment on any peculiarities in the declension of *supellex*, *locus*, *domus*, *vas*, *iugerum*, and *filia*.

2. Decline throughout—*domus ingens*, *nequam iuvenis*, *acer paterfamilias*, *plerique*.

3. Give the gender and genitive singular of the following: *cuspis*, *cucumis*, *palus*, *auceps*, *anas*, *hiemps*, *incus*, *decus*, *decor*, *tellus*, *virus*, *cadaver*, *quies*, *stipes*, *nemus*, *anus*, *annus*, *manus*, *mannus*.

4. Mention six words that differ in meaning in the singular and plural, stating their several meanings.

5. Decline *bos*, *vis*, *iusiurandum*, *nemo*.

6. Accent the following words: *tubicen*, *tibicen*, *pagina*, *perfidus*, *amicus*.

7. What nouns of the fifth declension have a full plural? Also give the rules of gender for that declension, with exceptions, if any.

8. Translate into Latin:—

(*a*) I do not know whether to praise or blame my brother.

(*b*) He was afraid that his friend would not come to Rome in three days.

(*c*) At the age of 60 he died at Capua, and was buried at Naples.

(*d*) I should like you to let me know when you will give me back the book.

French Course for March.

1. Five pages of translation a week, with a certain amount of written translation. The making of a vocabulary should be still kept up.

2. Grammar. Fasnacht §§ 25–33, and revision of the last two lessons. The numerals should be known thoroughly. The cases in which the cardinal numerals are found in French and not in English are important. Note that in the date of the year *mil* and not *mille* is employed in speaking of the Christian era. The year 1894 can be expressed in two ways, either *mil dix-huit quatre-vingt quatorze*, or *dix-huit cent quatre-vingt quatorze*. Note that *mille* when it means a mile takes *s*, never when it means 1,000, and that *un mille*, 'one thousand,' is bad French. Note that *vingt* and *cent* take an *s* when multiplied by a numeral and not followed by another, except when the cardinal number in French supplies our ordinal. Distinguish *Charles quint* and *Charles cinq*.

Note *le onze*, *le onzième*. Note that *second*, not *deuxième*, should be used if there are only two. Note *il y a quinze jours*, 'a fortnight ago.' Note the names of the months and days of the week. *Demi* agrees when it follows the noun, as *cinq heures et demie*, 'half-past 5,' but in *midi et demi*, *minuit et demi*, 'Half-past twelve p.m.' and 'half-past twelve a.m.,' it is attracted into the gender of *midi* and *minuit*, though referring to *heure* understood.

The declension of the personal pronouns should be known. Distinguish the uses of the *conjunctive* and *disjunctive* pro-

nouns. The order of precedence of the pronouns is important. The uses of *en*, *y*, and the pleonastic *le* are important. Note that the preposition 'to' with a personal pronoun, when expressing motion, is translated by *à* and the disjunctive pronoun, as *il vient à moi*, 'he comes to me.'

In Professor Darqué's book read what corresponds to the above.

English Course for April.

1. Hewitt & Beach, pp. 79–108; 302–317, or Morris's Outlines, Ch. XI., with Beach's Elements, pp. 32–41, 104, 105.

2. History from the end of William the Conqueror to end of Henry II.

English Notes.

History.—A description of the character of the various monarchs is often required. Lives of Lanfranc and Anslem are important. The Investiture dispute in which the latter was involved is very important. The claims of William II., Henry I., and Stephen to the throne should be known. The causes and results of the Crusades, with an account of the crusades in which the English took part, should be mastered. Note the Charter of Henry I., his war with Robert, and the battle of Tinchebrai. The perfection of the Conqueror's system by Henry I. should be learnt. Note the *Commune Concilium Regis*, the *Curia Regis*, the origin of Itinerant Justices and the Court of Exchequer. Note the progress of the Civil War in Stephen's reign, the Battle of Northallerton, and the state of England at that period. Note how Henry II. restored order when he ascended the throne, and succeeded in keeping down the power of the barons and the power of the Church. The life of Becket is most important, involving as it does the struggle for power between the King and the Pope. The various legislative enactments, viz., the Statute of Clarendon, the Assizes of Clarendon, the Assize of Northampton, and the Assize of Arms, should be learnt. Note Scutage, the Inquest of Sheriffs, Recognitors, the germ of Trial by Jury. The Continental possessions of Henry II. should be known. Be able to discuss the Conquest of Ireland. The Battle of Alnwick and the Treaty of Falaise are important on account of the claim to the supremacy of Scotland afterwards put forward by Edward I.

Grammar.—As we have stated before, the Matriculant cannot do better than constantly refer to old matriculation papers. In this month's course attention should be paid to the following points: Definition and Classification of Adjectives; the use of Adjectives as Attributes and Predicates; reasons for and against regarding the Article as a distinct part of speech; the advantages accruing to a language from the possession of articles; the derivation of Numerical Adjectives, especially twain, third, five, nine, ten, eleven, twelve, dozen, thirteen, twenty, score, hundred, million, myriad; the Comparison of Adjectives, regular and irregular, instances of Double Comparatives and Double Superlatives, Comparison formed by vowel changes, Comparatives formed by False Analogy, *e.g.* 'farther'; Adjectives that do not admit of comparison; discussion of the correctness of comparing words like perfect, golden, etc.; discussion of phrases like 'the largest circulation of any Liberal newspaper,' 'Eve, the fairest of her daughters,' 'more better' (*Tempest*), 'many a flower,' 'a few books,' 'the three first books,' 'our mutual friend,' 'a talented man,' 'a reliable person,' 'Every other day,' 'the most unkindest cut of all.'

Greek Course for April.

1. Iliad xxiv. 165–246. All the words that have to be looked up in the dictionary should be entered in a book, and constant reference made to Merry for the Homeric forms.

2. The numerals, pronouns, and the active voice of λύω. Students will find Underhill's exercises very helpful in remembering the verbs. Students should note in λύω that the future indicative is formed by adding σ to the stem, and then that the endings are the same as in the present indicative. Note that in the subjunctive a long vowel is substituted for the short vowel of the indicative; *e.g.*, ει becomes ῃ, ο becomes ω; note that ου becomes ω. There is no future imperative or subjunctive. Note that all the active subjunctives have the same endings. Note that the 3rd dual ends in την in the secondary tenses and in the optative. Note that the endings of the perf. indic. are the same as the first aor., save in the 3rd dual and 3rd plural. The optative ends in οιμι, οις, οι, etc., except in the 1st aor., when αι is substituted for οι, and in the 2nd and 3rd sing. and 3rd plural 1st aor. there are collateral forms, viz., ειας, ειε, ειαν, which are known as the Aeolic Aorist, and are used in Attic Greek. Note how the perfect is formed by reduplication. Note that the secondary tenses have what is called an augment, which signifies past time. This *augment*, which in verbs beginning with a consonant is the letter ε, is not kept in any mood except the indicative, as the other moods do not normally indicate past time. Students should learn λύω, so as to be able to run the different tenses not only through the persons, but also through the moods.

The pronouns are most important, and should be well known. Note that the dual fem. and gen. pl. fem. of οὗτος are the same as the masculine. Note that when ἐκεῖνος, οὗτος and ὅδε are used with nouns, the nouns must have an article, as οὗτος ὁ ἄνθρωπος, 'this man.' Note that the possessive adjectives when used with a noun are preceded by the article, as ὁ ἐμὸς πατήρ, 'my father.' Note that τις, *enclitic*, is 'someone': τίς = 'who?'

3. Two pieces of translation at sight a week.

MATHEMATICS.

Arithmetic Course for April.

Read Ratio and Proportion, and work problems depending on them, particularly Division into Proportional Parts. Use what has been called the 'Unitary' method wherever you can. If you do not know it, it is well worth making up. See Hamblin Smith's or Lock's Arithmetic. Nearly all the difficult problems in arithmetic depend on Proportion.

Algebra Course for April.

Read Simultaneous Equations, and work examples. Note carefully the *three* ways in which one letter may be eliminated from two equations. Apply all three methods to the first few questions you work at. When you are quite clear in your mind about the meaning of Elimination and the different methods of performing it, there can be no difficulty in any form of Simple Simultaneous Equation. Solving a long series of examples of exactly similar kind is so much waste of time.

The unknowns, instead of being simple letters like x and y, are sometimes combinations of letters, like $\frac{1}{x}$ and $\frac{1}{y}$, or $\frac{x}{y}$ and $\frac{y}{x}$. In this case it will be better for the beginner to replace these combinations by single letters. *E.g.*:

$$\frac{3}{x} + \frac{2}{y} = 13,$$
$$\frac{4}{x} - \frac{1}{y} = 10.$$

Let $\frac{1}{x} = p$, and $\frac{1}{y} = q$, then the equations become

$$3p + 2q = 13,$$
$$4p - q = 10.$$

From these we find $p = 3$, and $q = 2$.

$$\therefore x = \tfrac{1}{3} \text{ and } y = \tfrac{1}{2}.$$

Be sure to remember that there must be as many equations as there are unknowns, and that these equations must be *independent of each other*. For instance, from the equations—

$$\left.\begin{aligned} 4x - 3y + z &= 7 \\ 7x + 2y - z &= 9 \\ x - 8y + 3z &= 5 \end{aligned}\right\}$$

no values of x, y, and z can be found, for by doubling the first equation, and subtracting the second, we get the third. The third is not therefore an *independent equation*.

Euclid Course for April.

Finish Book II. For those who are weak in this book, there is one, and only one, secret of becoming sound. *Learn each enunciation in its order*—not necessarily in the exact

words of your text book, but in the exact meaning. Until they are known it is practically impossible to know the subsequent propositions proved by them.

The three cases of II. 13, first given in full by Simson, and copied from him by many other editors, need not be learned. The single proof given in Hall and Stevens, and in the notes to Todhunter, is sufficient.

Riders:

(1) The sum of the squares on the two sides of any triangle is equal to twice the square on half the base, and twice the square on the line joining the vertex to the mid point of the base.

(2) The sum of the squares on the sides of any quadrilateral is equal to the sum of the squares on its diagonals, together with four times the square on the line joining the mid points of the diagonals.

(3.) If a line AB be divided at C as in II. 11, and if from CB, the greater segment, a part CD be cut off, equal to CA, show that CB is now divided at D as in II. 11.

(4.) Show how to find a point C in AB produced so that the rectangle AC CB may be equal to the square on AB.

(5.) Show how to bisect any rectilineal figure by a line drawn from one of its angular points.

Hints on the March riders:

(1.) (*a*) In this question 'least' should have been printed 'greatest.' Since the rectangle under any two unequal parts is always less than the square on half the line (II. 5), therefore the rectangle contained by the two halves of the line (which is evidently the square on half) is greater than any other rectangle.

(*b*) If AB be the line, and P *any* point on it, and C its mid point, then rectangle AP PB is equal to the difference between the squares of AC and CP (II. 5). On AC describe a semicircle. Lay off a chord AD in it, equal to the side of the given square. Join CD, and cut off from CB a part equal to CD.

(2.) This follows at once from the preceding.

(3.) Let AB and BC be the lines, and place them so that they are conterminous, and in the same straight line. Produce the whole line AC towards C, and cut off BD equal to BA.

Then rect. AC CD = diff. of sqq. of AB and BC (II. 5).

(4.) Let P be mid point of BC, and join AP.

Then diff. of sqq. of AB and AD = diff. of sqq. of BP, and PD (I. 47) = rect. BD DC (II. 5). (Misprinted last number.)

(5.) Apply II. 6 instead of II. 5 as in last.

MECHANICS.

Course for April.

Falling bodies, projectiles, &c. These should not be treated of separately, but merely as examples of the three Kinematical formulæ given last month. No investigation of the shape of the orbit of a projectile is required for Matriculation, so that you may pass over the Parabola and all concerning it.

Note carefully the following:—

(1.) When a body has reached its greatest height, $v = o$.

(2.) When a body has returned to its initial position, $s = o$. (For the distance between the positions of the moving particle at the beginning and the end of the time considered is o.)

(3) If a body possess two different velocities (for instance, a horizontal and a vertical velocity), each of these has its own full effect in its own direction, independently of the other.

Example:

A body is projected with two velocities, one of 64 ft. and sec. vertically upwards, and one of 12 ft. and sec. horizontally. Find its range on a horizontal plane.

Here we have simply to find the Time of Flight due to the vertical velocity (put $s = o$ in formula II.), and having found this (4 secs.), we find how far it would travel in 4 secs. under its horizontal velocity of 12 fs. Its vertical motion is not interfered with by its horizontal motion, nor is the latter interfered with by the vertical motion or the vertical acceleration.

Notes on the March Course.

In some works the Kinematical formulæ are first proved for the case when there is no initial velocity; and then proved over again for the case when there is an initial velocity. This leads to confusion and loss of time. If there is no initial velocity, simply put $u = o$ in the formulæ.

It is essential to be quite clear about the exact meaning of s in the formulæ. For instance, a body is thrown upwards from the top of a tower 160 feet high, and after rising it falls past the point of projection to the bottom of the tower. Here $s = 160$, no matter how high the body may have risen. To find the Time of Flight, put $s = 160$, in the formula $s = ut + \frac{1}{2}$ ft.^{2}, and suppose the initial (upward) velocity is 48 fs. This gives $100 = -48t + \frac{1}{2} \cdot 32 \cdot t^2$, which gives $t = 5$ or -2 secs.

Here another difficulty has arisen, very perplexing to many beginners—how are the *signs* of the various quantities in the formulæ determined? The signs depend entirely on the directions in which the quantities are measured. You may select whatever direction you please as positive, and then remember that velocities or accelerations acting in that direction, and distances measured in that direction, will be positive, and in the opposite direction negative. In the example just selected, the distance of 160 ft. was measured *downwards*, and was called positive; consequently the initial velocity, which was *upwards*, must be negative, and the acceleration, which acts downwards, must be positive.

I might just as well have selected the direction of the initial velocity (*i.e.*, upward) as the positive direction; then the distance and acceleration would both be negative, and the equation would be: $-160 = 48t - 16t^2$.

Two solutions were obtained for the time of flight. The negative result, -2 secs., is easily seen to be the time *before* the actual moment of projection that the body should be thrown up from the bottom of the tower so as to reach the top at the actual moment of, and with the actual velocity of, projection.

Recollect that every question in Kinematics in your course must depend directly on the Parallelogram of Velocities and these three Kinematical formulæ.

CHEMISTRY.

Course for April.

Oxygen.—Physical properties. Preparation (1) from HgO, (2) from $KClO_3$ (note here the two stages of the reaction, and the Catalytic action of CuO and MnO_2), (3) from air by BaO_2 (4) from Water by Electrolysis.

Ozone.—Its physical properties (especially smell and density). Its molecular formula. Its action on KI. Its general tendency to oxidise. Action of heat upon it.

Water.—Experimental proofs of its composition.

(1.) By *volume*, (*a*) synthetically by Eudiometer, (*b*) analytically by electrolysis. (Note here the causes which prevent the volume of O being exactly half that of the H; *i.e.*, difference of solubility, and the production of ozone.)

(2.) By weight; synthetically by passing pure H over heated CuO. Note the various tubes used, and what they are used for.

Correspondence.

Teachers wishing to have their test papers corrected should send the same addressed to the 'Matriculation Editors,' care of Joseph Hughes and Co., Froebel House, St. Andrew's Hill, Doctors' Commons, London, E.C., and enclose a remittance of 6d. for each paper.

Next month there will be test papers in Latin, French, Mechanics and Mathematics.

The Matriculation Editors will be pleased to reply briefly through these columns to those seeking advice.

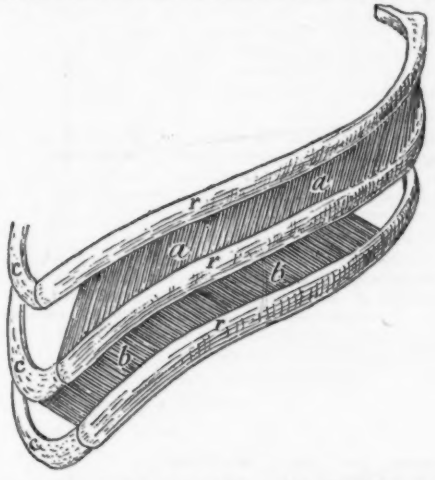
NOTES ON PHYSIOLOGY:

EMBRACING THE SYLLABUS (ADVANCED AND HONOURS STAGES) OF THE SCIENCE AND ART DEPARTMENT.

BY WALKER OVEREND, M.B. (OXON.), B.SC. (LOND.).

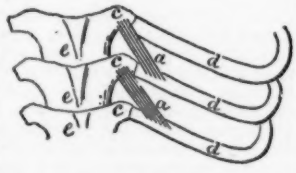
69. *Respiration.*—The object of respiration is to effect an interchange of gases between the blood and the air inspired. By this means oxygen enters, and carbon dioxide is liberated and passes out with the expired air. It is, therefore, absolutely necessary that the blood and inspired air should be brought into as close contact as possible.

70. The chest consists of an osseous framework. Posteriorly lie the dorsal vertebræ, and connected with each is a pair of ribs, which pass forwards to be united with the sternum by means of the *costal* cartilages. Filling up the intervals between the ribs are the *intercostal muscles.* Of these there are two sets—an *external*, consisting of fibres which run from behind forwards, and cease at the costal cartilages. The *internal* intercostal muscles run in the opposite direction, but do not reach so far behind as the external intercostals.



A Diagram showing the direction of the External Intercostal Muscles, *a*, *a*; Internal Intercostals, *b*, *b*; *c*, *c*, Costal Cartilages; *r*, *r*, Ribs. The space between *c* and *b* should have been completely filled with muscular fibres of the internal intercostal muscles.

Bands of muscular fibres also pass from the transverse processes of the vertebræ to the ribs, called *levatores costarum.* There is also a bundle of muscles on each side of the neck passing from the transverse processes of some of the cervical vertebræ to the first



A Diagram of the Action of the Levatores Costarum; *e*, *e*, posterior surfaces of the vertebræ: *c*, *c*, transverse processes; *a*, *a*, levatores costarum; *d*, *d*, ribs.

and second ribs, and called the *scaleni* muscles. Other muscles termed *serrati*, pass from the scapula to the sides of the ribs. The floor of the chest is formed by the *diaphragm.* Its central part is tendinous, while the sides, all round, are muscular, and the fibres pass to the six lower ribs. In it are three openings, one for the inferior vena cava, one for the œsophagus with the two vagi nerves, and one behind for the aorta and thoracic duct.

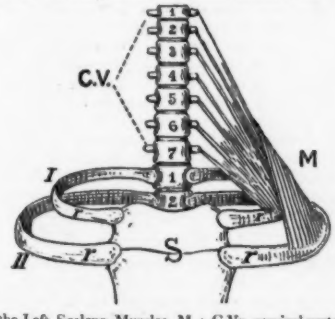


Diagram of the Left Scalene Muscles, M.; C.Vr, cervical vertebræ; I., II., 1st and 2nd ribs; S., sternum; *r*, *r*, costal cartilages joining sternum.

71. The main air-tube or *trachea* is about 4½ in. long, and divides into two branches—the *bronchi*, one for each lung. In the lung each bronchus divides and subdivides, again and again, until it reaches a diameter of about $\frac{1}{75}$ of an inch, when it ends in very delicate pouches, about $\frac{1}{150}$ of an inch in diameter, called the *alveoli* or *air-cells.* The *trachea* consists of a series of cartilaginous rings, which, however, are incomplete behind. Internally the trachea is lined by a mucous membrane, the epithelium of which consists of three or more layers of cells, the superficial layer of cells being *columnar* and *ciliated*, the cells in the deeper layers are oval or rounded, and not ciliated. Between the ends of the cartilaginous rings is a layer of unstriped muscle. The *bronchi* possess a similar structure, but as each bronchus divides within the lungs a gradual change in structure takes place. The cartilaginous rings become irregularly-shaped masses, while the muscular fibres gradually come to encircle the tube, forming a complete ring. In the smaller bronchial tubes the cartilages disappear altogether. At the alveoli the structure again changes, the epithelium lining them consists of a single layer of flat cells, which have lost their *cilia*, and the muscular layer disappears. The walls of the alveoli are strengthened by elastic tissue.

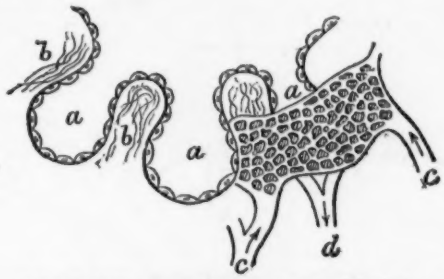


Diagram of Air Cells, highly magnified to show network of Capillaries; *a*, *a*, *a*, air vesicles; *b*, *b*, elastic fibres; *c*, *c*, terminal branches of the pulmonary artery; *d*, commencement of pulmonary vein.

The terminal branches of the *pulmonary artery* surround each alveolus, and capillaries pass from them to cover the whole surface of the alveolus. From opposite sides branches run to join others, and finally to end in the four pulmonary veins. The nutrient vessels of the lung, called bronchial arteries, arise from the aorta or from its intercostal branches. The nerves of the lung pass from the vagi. Also some pass from the sympathetic to supply the blood vessels and the unstriped muscle of the bronchi.

72. The lungs, with the heart, great vessels and œsophagus entirely fill the thorax. Each rib is bent in two directions—it is convex outwards, and the sternal end is lower than the vertebral end. By the contraction of certain muscles the cavity of the chest is enlarged, and the lungs must become larger in volume also, since the two layers of the pleura—parietal and visceral—keep in close contact, moving smoothly the one over the other. Air must, therefore, enter the lungs from outside. This act constitutes *inspiration.* The elasticity of the chest-walls and of the lungs themselves then comes into play, and the chest returns to its original shape, and air rushes out—*expiration.*

73. Since the chest has the shape of a box or cavity, it is possible to enlarge it in three principal diameters—from front to back (antero-posteriorly), from side to side (laterally), and from above downwards (longitudinally). The chief muscle of inspiration is the diaphragm. It forms a dome-like partition between the chest and abdomen, and is supplied by the two *phrenic* nerves which pass to it from the fourth and fifth cervical spinal nerves. When the diaphragm contracts, the central tendon remains comparatively fixed, but the curved muscular fibres at the sides shorten and become straighter, and thus enlarge the cavity of the chest from above downwards. In thus descending, the diaphragm presses on the stomach and liver, and causes a heaving of the abdominal wall. Each rib is connected by means of two joints with the backbone; the *head* is connected to the *body* of the vertebra, and the *tubercle* of the rib articulates into the *transverse process* of a dorsal vertebra. When a rib is elevated, the sternal end is arried upwards and act the same time forwards. Since the arches of the ribs increase in their sweep from the second to the seventh, when a lower rib as the sixth is raised so as to occupy the position of the one above it, the chest becomes wider laterally, and the thrusting of the sternum

forwards also increases the antero-posterior diameter. Every muscle which *raises* the ribs therefore must be *inspiratory*. With regard to some muscles there is no doubt of this. The levatores costarum and the scaleni are certainly inspiratory.

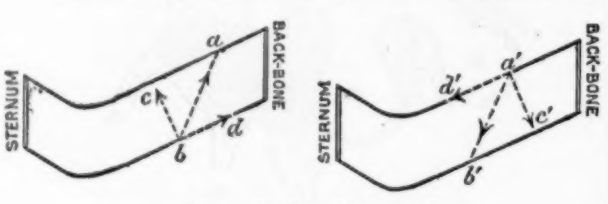
74. When respiration becomes embarrassed owing to obstruction in the air-passages or from disease of the lung, other muscles are brought into action, both during inspiration and expiration. These are called *extraordinary* muscles of respiration. They are the sternomastero muscles, the pectoral muscles, the trapezius muscles, and others. In difficult *expiration*, also the muscles of the abdominal wall become of great service by pressing upon the contents of the abdomen, and thus pushing the diaphragm upwards.

75. Normal inspiration is, however, chiefly performed by

(1) the diaphragm,
(2) the levatores costarum.

But with regard to the intercostal muscles themselves, there has been great divergence of opinion. The best way of regarding the subject is as follows :—

The *external* intercostal muscles elevate the ribs, and are therefore *inspiratory*. For let *ab* represent the direction of one of the fibres. When the muscle acts as an elevator of the ribs, as in the first figure, the force may be resolved into two, one of which *bd* has no influence, but *bc* then acts at a much greater leverage than does the force *a'c'* in the second figure, where the muscle is supposed to act in the opposite direction. The force *bc* would consequently overcome *a'c'*, and the rib would be elevated. A similar



Diagrams of the External Intercostal Muscles.

method of reasoning convinces us that the internal intercostal muscles *depress* the ribs, and are, therefore, muscles of *expiration*. We must except, however, that portion of the internal intercostal muscle which lies between the costal cartilages. For in this case the moveable joints are at *n* and *p* where the cartilages *mn* and *op* join the ribs. The force *a'c'* acts at a greater leverage than *bc* in

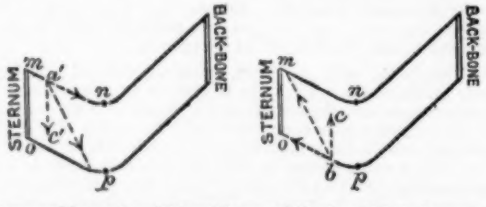


Diagram of that portion of Internal Intercostal Muscles which lies between the Costal Cartilages.

the first figure, and is hence the effective one. But when *a'c'* contracts it tends to straighten the curve at *n* and *p*, push the sternum outwards, and thus increase the diameter of the chest. This portion of the internal intercostal muscle is therefore *inspiratory*. As a matter of fact, however, neither set of muscles come much into activity during ordinary quiet respiration.

76. Besides the contraction of the muscles of the chest which induce inspiration, there are other *associated movements*. During quiet respiration the *vocal cords* move little. But if respiration becomes laboured, the glottis is dilated with every inspiration by means of the posterior crico-arytenoid muscles. In men, as a rule, there is no movement of the nostrils observable during quiet breathing. When respiration becomes difficult or is quickened, as after great exertion, then the nostrils dilate with every inspiration. In rabbits the dilatation of the nostrils is always seen, and occurs a fraction of a second before the contraction of the diaphragm.

77. *The Chemistry of Respiration.*—Inspired or ordinary atmospheric air consists of 21 parts per cent. of oxygen, 79 nitrogen, and a trace of carbon dioxide (CO_2). In expired air, that is, air which has been breathed, there is a great increase of the carbon dioxide.

Inspired Air.	Expired Air.
Oxygen, 21 parts per 100. Nitrogen, 79 parts per 100. Carbon dioxide, 4 parts per 10,000.	Oxygen, 16 parts per 100. Nitrogen, 79 parts per 100. Carbon dioxide, 4 parts per 100.

Expired air also is nearly saturated with aqueous vapour, and its temperature is very nearly that of the body itself.

78. After the greatest effort at expiration, the lungs still contain air—*residual*. This amounts to about 2,000 cubic centimetres. During ordinary breathing, a person inspires and expires at each breath about 500 cubic centimetres (30 cubic inches) of air. This is termed *tidal* air. By making a greater effort it is possible to take in about 1,500 cubic centimetres in addition. This is termed *supplemental* air. Also about 1,500 cubic centimetres may be expired by great muscular exertion. This is termed *complemental* air. When an individual fills out his lungs completely, and then empties them as much as he can, the amount finally expired amounts to 1,500 + 500 + 1,500 = 3,500 cubic centimetres (210 cubic inches). This amount is termed the *vital capacity*. One inch of height, or one inch of circumference, makes a difference of about 150 cubic centimetres. Dr. Edward Smith devised an instrument to measure the vital capacity. It is merely a gas-meter with a gauge.

79. Since the tidal air is only about $\frac{1}{10}$th the quantity of air in the lungs, it can never reach the alveoli. But diffusion takes place between this and the alveolar air, the CO_2 passing outwards, and oxygen passing inwards. Hence the alveolar air must contain less oxygen and more carbon dioxide than the air in the trachea and bronchi.

80. The blood driven into the lungs is *venous* ; that which leaves by the pulmonary veins and passes to the left auricle is *arterial*. Venous blood is darker than arterial, and contains more carbon dioxide. From 100 volumes of blood, about 60 volumes of gas may be extracted by the air-pump. The difference in the composition of this gas is shown in the table.

—	Arterial Blood.	Venous Blood.
Oxygen - -	20 volumes	15 volumes
Carbon dioxide -	40 ,,	45 ,,

The oxygen of the blood is almost entirely associated with the *Hæmoglobin* or colouring matter of the red corpuscles. This is obviously the case, since plasma itself from an atmosphere of pure oxygen will only absorb about 4 per cent., and from atmospheric air barely one per cent. Now, one gramme of hæmoglobin will unite with and absorb 1·6 cubic centimetres of oxygen at 0°C, and the ordinary atmospheric pressure. The amount of hæmoglobin in the blood is about 14 per cent. It follows, therefore, that in 100 cubic centimetres of blood there are 14 grammes of hæmoglobin, and this amount will combine with 14 × 1·6 = 22 cubic centimetres of oxygen, that is 22 per cent. Arterial blood, therefore, is not quite saturated with oxygen, but to the extent of about nine-tenths only. Now, if we submit arterial blood to a gradually diminishing pressure of oxygen, that is, to a vacuum which is becoming more perfect, for a long time no oxygen is evolved at all, but when a certain low pressure is reached all the oxygen comes off suddenly and rapidly. The absorption of oxygen by the blood is, therefore, not directly dependent upon the pressure. In fact the absorption of oxygen from the alveolar air is a chemical process. The compound formed is termed oxyhæmoglobin, but it is eminently unstable, its decomposition following a great reduction of pressure. These facts enable us to understand the absorption of oxygen in the pulmonary circulation. Venous blood in the pulmonary artery contains only 12–15 volumes of oxygen per cent., and the pressure of oxygen in the alveolar air is certainly not less than $\frac{1}{3}$ of an atmosphere or 90 millimetres, and the decomposition of oxyhæmoglobin only occurs when the pressure of oxygen becomes $\frac{1}{10}$ of an atmosphere. Hence the venous blood will take up oxygen from the alveolar air.

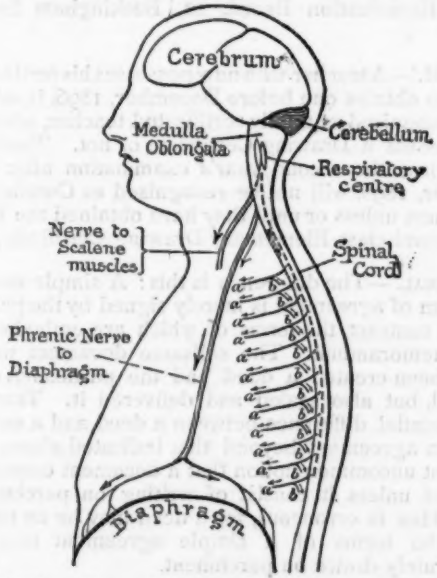
80. The bright arterial blood leaving the lungs is distributed over the body. All the tissues, especially the muscles, are poor in oxygen, and still have a great avidity for it. This effect makes itself felt through the capillary walls, and the plasma, as far as the oxyhæmoglobin of the red corpuscle. The latter is unable to keep

its integrity, and some oxygen is liberated as the corpuscle rushes past. Hæmoglobin has, therefore, been called the *oxygen-carrier*. As a result of oxidation *in the tissues*, CO_2 is produced, which again reaches the blood by traversing the lymph stream, or by diffusing through the capillary wall into the blood directly. When a vein is opened, the dark red fluid oozes out, and on exposure to air becomes brighter, and more like arterial blood. By adding a reducing agent to blood, contained in a glass vessel or test-tube, the colour of the blood may be re-darkened. As reducing agents, sulphide of ammonium, or a solution of ferrous sulphate and ammonia containing tartaric acid may be used.

81. The relations of carbon dioxide in the blood are somewhat less clear. We have said that 100 volumes of blood may contain 45 volumes of CO_2. The greater part of this is contained in the plasma. The greater part of this may be extracted by means of an air-pump. About 90 per cent. of the CO_2 appears to be in a state of chemical combination. By what means the CO_2 leaves the plasma and enters the alveolar air, is not yet finally settled. When a gas like CO_2 is dissolved in a fluid like the plasma, and this plasma is then exposed to an atmosphere containing the same gas, if the quantity or *tension*, as it is termed, of the CO_2 in the atmosphere is very small, the plasma containing a fair amount of the gas, suffers a loss, and this passes into the atmosphere in contact with the plasma. The gas is said to diffuse. But blood as it moves along the vessels, although it contains much CO_2, gives up very little to an atmosphere containing only traces of the gas. This has been demonstrated experimentally. It is, therefore, difficult to explain its diffusion into the alveolar air from the blood. It is possible that there is some secretory activity on the part of the epithelium lining the air-vesicles, and that the pulmonary cells actually excrete CO_2 from the blood into the alveoli, just as the liver-cells secrete bile.

82. *Nervous Mechanism of Respiration.*—The medulla oblongata contains a certain area; injury or obstruction is followed by cessation of respiration and death. This is called the *respiratory centre*. It is situated close to the spot where the two vagi nerves enter it. The nerve cells of this centre are constantly sending down impulses along nerves in connection with it to the muscles. These are *efferent* or motor impulses. Such nerves are—

(1) the phrenic nerves to the diaphragm,
(2) nerves passing to the intercostal muscles,
(3) nerves passing to the levatores costarum scalemi, etc.

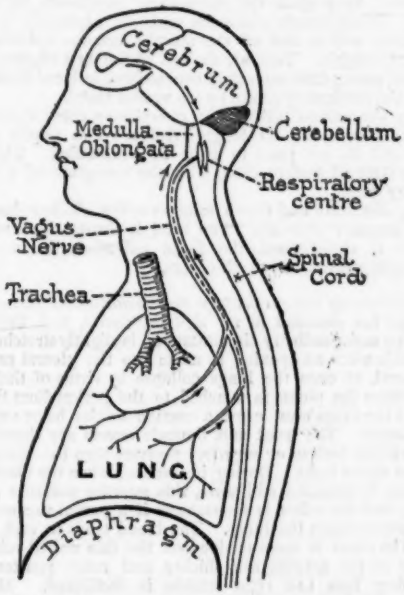


The Respiratory Centre and its Motor or Efferent Nerves: *a*, *a*, *a*, nerves to intercostal muscles; *b*, *b*, to levatores costarum muscles.

When the phrenic nerve on one side is cut, the diaphragm is paralysed on that side; and if both are divided, the diaphragm becomes completely paralysed and still. Death does not immediately follow, since the elevators of the ribs, whose nerves come from the lower part of the cervical and from the dorsal part of the spinal cord, are still in action, and can produce some enlargement of the thoracic cavity. If the spinal cord be cut at the upper part of the chest, the movements of the ribs cease.

83. *Afferent Nerves.*—Nearly every sensory nerve in the body may, under certain conditions, influence the rhythm of respiration. The usual sequence is inspiration, then expiration, followed by a pause. Painful impressions on the skin may quicken or slow the respirations. It is extremely easy to influence the respiration through the skin of the chest and abdomen. Touching these regions with cold water produces a very deep inspiration.

84. *The vagi nerves* are the most important afferent nerves in connection with the respiratory centre. If both vagi are suddenly divided, the respirations become much slower and deeper. But when the end, still in connection with the medulla, is stimulated by the interrupted current, the respiration become quickened again, and may reach the normal number. Occasionally the effect of the current is to produce an *increase* in the *expiratory* movements only.



The Respiratory Centre and its Afferent or Sensory Nerves.

This effect is better seen on the stimulation of the superior laryngeal nerve—a branch of the vagus entering the larynx. Stimulation of this nerve induces first a stoppage of *inspiration*, and then a forcible contraction of the expiratory muscles. Evidently the vagi contains two kinds of afferent nerve fibres, one, inspiratory fibres, and expiratory. Since section of both vagi induce a slowing of respiration, it is evident that, under ordinary conditions, impulses travel by this nerve to the respiratory centre and quicken its activity. It has been thought that the lungs possess a self-regulating mechanism. In other words, that the expiratory fibres are stimulated when the air-vesicles are distended, and they therefore bring about the following expiration, and the inspiratory fibres are stimulated when the lungs are collapsed. To test the truth of this hypothesis, it is necessary to study the effect of inflation or distension and its opposite on the respiration. When air is driven repeatedly into the lungs the experiment is termed *positive* ventilation, and when air is sucked repeatedly out of the lungs, *negative* ventilation. If a rabbit be quietly breathing, and air be repeatedly blown into the lungs, the inspiratory movements gradually lessen, until the diaphragm stands still altogether and the inspirations cease. This may be followed by strong expiratory movements. Distension of the lungs, therefore, appears to inhibit inspiration and produce expiratory efforts. The opposite condition, that of sucking air out of the lungs at regular intervals, finally sends the diaphragm into one long inspiratory spasm. Collapse of the lung, therefore, augments inspiratory movements. It follows then that each inspiratory movement causes an expansion of the lungs, and this expansion stimulates the ends of the vagi within the lungs, inhibits the inspiratory movement itself, and induces the next expiratory effort. In this way the activity of the respiratory centre is kept up not by any venous condition of the pulmonary blood, but in a reflex manner through the agency of the vagi nerves.

85. *Apnœa.*—If by means of artificial respiration the lungs are inflated at very short intervals, the respirations gradually become shallower, and finally cease for a short time. This stand-still of respiration is called apnœa. It appears to be reflex in origin, and

produced by irritation of the ends of the vagi in the lungs by the quick succession of distension and collapse of the alveoli. For the same occurs if the lungs are inflated by hydrogen or nitrogen instead of atmospheric air. It cannot, therefore, be due to a saturation of the blood with oxygen. The standstill of respiration is certainly not so prolonged as with air or oxygen, since when hydrogen is used the blood becomes so venous that the stimulation of the respiratory centre by the excess of CO_2 overcomes the reflex excitation from the alveoli, and respiratory movements occur sooner.

86. *Asphyxia.*—If from any cause, an animal suffers from a deficiency of oxygen, dyspnœa or difficult breathing follows, and if the cause be not removed, the dyspnœa passes into asphyxia. Three stages are to be recognised before death finally occurs. During the the first minute the respirations become quicker and deeper (dyspnœa). Very soon the respiratory movements become very marked. Every muscle which can assist in expiration is brought into activity and at last all the muscles become involved in the expiratory struggle. Towards the end of the first minute, indeed, the animal passes into expiratory convulsions, induced by the stimulation of the respiratory centre by the venous blood.

During the second minute the convulsions cease suddenly and expiratory efforts are no longer visible. The pupils are fully dilated, and do not react to light by contracting. The animal lies in a state of perfect calm, with the exception of a few deep inspiratory gasps.

During the third and fourth minutes a few shallow inspirations occur at irregular intervals. The head is thrown back with each, the back is straightened, the limbs extended, the mouth and nostrils open widely, and death occurs.

87. *Influence of the respiratory movements on the circulation.*—The lungs are enclosed in an air-tight cavity, and their elastic tissue, even under ordinary circumstances, is slightly stretched. This is noticeable when an opening is made into the pleural cavity of a dead animal, at once the lungs collapse by virtue of their elastic tissue. Since the pleura is attached to the pericardium the slight tension of the lungs must exert a traction on the heart and vessels in the thorax. The heart and thoracic vessels are therefore subjected to a less (*minus or negative*) pressure than the blood-vessels of the rest of the body. During inspiration, when the elastic tissue of the lung is stretched still more, this *negative pressure* naturally increases, and the effect is the same as if a partial vacuum existed in the space between the lungs. The blood tends to rush into the chest. The effect is more obvious on the thin walled veins, since the coats of the arteries are thicker and more resistant. The venous flow into the right auricle is facilitated. Moreover, during inspiration the pressure upon the capillaries of the lungs become slightly less than in expiration, they *dilate* somewhat, and offer less resistance to the flow of blood. These two factors lead to a stronger beat of the heart and an *increased pressure* of blood in the arterial system during inspiration.

When the blood-pressure is recorded as a tracing the ascent of blood-pressure due to inspiration, and the fall during expiration are plainly visible as large undulations. But under certain circumstances much larger curves (*Traube's curves*) appear in the blood-pressure tracing. They appear in the absence of all thoracic movements, and even after both vagi nerves are divided. It is probable, therefore, that they are due to the activity of the vaso-motor centre itself in the medulla, the rise being due to a constriction of the smaller arteries, the fall of the wave being brought about by a dilatation of the same.

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We have noted one or two rather awkward expressions; for example, 'The task of *quietening* the country,' on page 190.

In the account of the battle of Assaye it is stated, on page 93, that 'the Mahratta army was far superior in point of numbers.' In the summary of the lesson, on page 233, this is developed into the inaccurate expression, 'a Mahratta force of infinitely greater numbers.'

The Intermediate History of England from B.C. 55 to 1887. By H. F. Wright, M.A., Ll. M. London: George Bell and Sons.

The author of this text-book offers, in his preface, some apology 'for introducing a new Students' History of England, when so many excellent text-books are already in the field.' He considers, however, that it may find a place intermediate between the short elementary class-book, and the more advanced text-book in two or three volumes. He has had specially in view the needs of candidates for Matriculation, and for the Sandhurst Army examinations. To meet the latter, the period since 1689 is treated with much greater fulness than the earlier periods. Special attention is paid to questions of Foreign policy, and in the latter part of the book to those of Ministerial policy. Chronology is very prominent, and the tables are numerous and full. We are not told who is responsible for the introductory section called 'Helps to Memory,' but the preface informs us that these are inserted by kind permission. Systems of mnemonics are apt to be touched with absurdity, but we do not remember a more thorough farrago of absurdity than is sketched out briefly in these 'helps.' Many people, no doubt, find a difficulty in remembering dates; but, though we are told that 'it will be found very difficult to forget the dates if they are once mastered by this system,' we fear that a greater difficulty would be found in mastering the system; and if doing this

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were necessary to mastering the dates, it would be as well to try to get along without them. Here are some samples. Note that certain consonants represent tens and units, certain vowels represent hundreds in the dates:—'Cæsar's second invasion, B.C. 54. *l* = 5, *r* = 4, vowel sound *ă* = *lăr*: Cæsar larfed, not perhaps a happy expression, but one easily remembered.' '1346, Battle of Crecy, *rĕk*. Say Battle of Creeky.' '1776, Independence of America. *Joke*.'

Kindness may have prompted the insertion of these mnemonic notes, but it might have been kinder to withhold them. However, they occupy little space, and have little to do with the history, which appears to be sufficiently full, and carefully compiled.

Mr. Wright pleads in his preface 'For deficiencies of style, want of time may be a fair excuse.' He appears to feel the need of some excuse; but he should have thought of the maxim *Qui s'excuse, s'accuse*. Truly the style might be better, and we might feel justified in expecting better from a classical scholar and honours man. Here, for example, is an awkward sentence:—'It is generally supposed that Edward was weak rather than vicious—a man with no fixed aims, relying for advice on the latest favourite, and could not hold his own in these troublous times' (p. 78). Here is another on the next page:—'Henceforth the Despensers were supreme; there seemed no means of shaking their influence; a truce with Scotland was concluded, and danger from that quarter averted.'

The matter of the book appears to be well suited for its purpose, but its method seems open to question. The division into ten books corresponding to certain periods may be reasonable, but their subdivision into reigns is somewhat antiquated, and the adoption of the plan of breaking up the text by head lines like those in the American newspapers is not likely to be so helpful to the student as the use of Clarendon type paragraph headings.

The French Verb on the Historical or Derivative System. By Cecil A. Gould. London: Jarrold and Sons.

The compiler of this thin quarto volume seeks to help the student of French grammar to master the difficulties of the verb by adopting a rational arrangement of the various forms according to the five Primitive Parts, from which all the tenses are derived. The plan followed is to arrange in five columns on one opening of the book the several tenses of the verb *porter*. At succeeding openings the conjugation of other verbs is similarly displayed; and, as the scheme has in it a distinctly logical element, and as the corresponding forms always occur in the same position on the page, the pupil cannot fail to find help in understanding and remembering the forms and applications of the tenses. The substitution for the usual misleading names of the three past tenses of the more reasonable and significant names, Progressive, Conversational, and Historical or Narrative, is a very satisfactory and helpful feature.

Spaces in the columns which would otherwise be blank are utilised for occasional notes, questions, and suggestions. Altogether the work is one which may help the young student to evolve something like order out of what is apt to appear a veritable chaos.

The last few pages are occupied with lists of the irregular verbs classified according to their peculiarities. On page 7 we observe a circumflex accent is wanting in the word *portâtes*.

The Royal Copy Books: Nos. 9 to 16. London and Edinburgh: T. Nelson and Sons.

The distinguishing feature of this series of Copy Books is an arrangement by which the head-lines, though they are stitched and held firmly in the cover, are cut through so that they can be turned over separately from the paper to be written on. This makes it possible for any head-line to be copied on any page of the book, and so for all writers in the same class to be practising the same writing at once.

The writing has distinctive features also. It is very clear and uniform, is but very slightly sloped, and is much like the best civil service hand. The letters are rather narrow compared with the space between the letters, and this becomes more noticeable in the higher numbers which contain the advanced small-hand. By some this is regarded as a merit, but we prefer the ordinary spacing with the writing vertical or nearly so. The engraving is well done, and the paper appears to be of excellent quality.

The Royal First and Second Writing Books. London and Edinburgh: T. Nelson and Sons.

These small books in octavo are intended to accompany the Royal Copy Books, and contain the initiatory steps, with small and large letters and short words carefully graduated according to difficulty of formation and joining of letters. Space is provided for practice, and every other page is ruled in squares for practice in figures and sums.

They will be found suitable in some schools for home work.

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The Musical Times. This well known and excellent musical journal appears in a new dress, and with several improvements. It is now permanently enlarged to 72 pages; the paper is of superior quality; in the more important sections the typography has been improved; and altogether, though the price remains as before, the general get-up of the work, and the character of its contents indicate a laudable desire on the part of Messrs. Novello and Co. to keep pace with the great advance in musical skill and knowledge which is such an important feature of the artistic development of modern England. The proprietors also announce the frequent presentation of an extra musical supplement. The supplement issued with the January number is 'The Story of the Cross,' by Sir John Stainer—a most effective composition for Eastertide services, which is alone worth the whole cost of the book.

George Frederick Handel: An extra edition of the 'Musical Times' issued in December last. All lovers of Handel's music should purchase this really admirable collection of Handelian biography, criticism, and illustration. We have never seen a more thoroughly able and popular presentation of the salient features of the great master's life and work. The portraits, fac-similes, and autographs are most interesting.

The School Music Review for February, in addition to much other matter of great interest to school teachers, contains a very important article on the 'naming of intervals,' which every candidate for examination under the Education Department should carefully study.

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